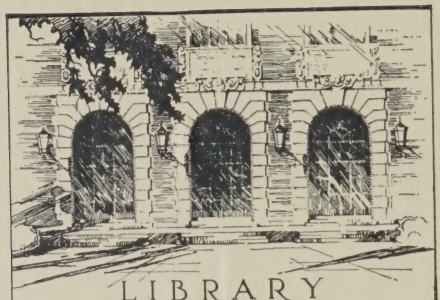

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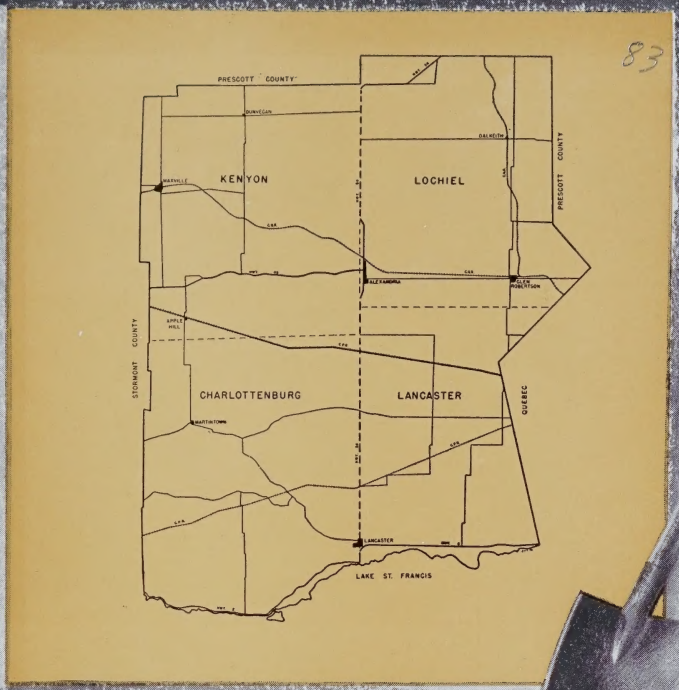

SOIL SURVEY OF GLENGARRY COUNTY

REPORT No. 24 OF THE ONTARIO SOIL SURVEY

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Prepared jointly by The Experimental Farm Service, Canada Department of Agriculture and the Ontario Agricultural College

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SOIL SURVEY
of
GLENGARRY COUNTY

by

B. C. Matthews and N. R. Richards
Ontario Agricultural College

and

R. E. Wicklund
Central Experimental Farms Service

GUELPH

May, 1957

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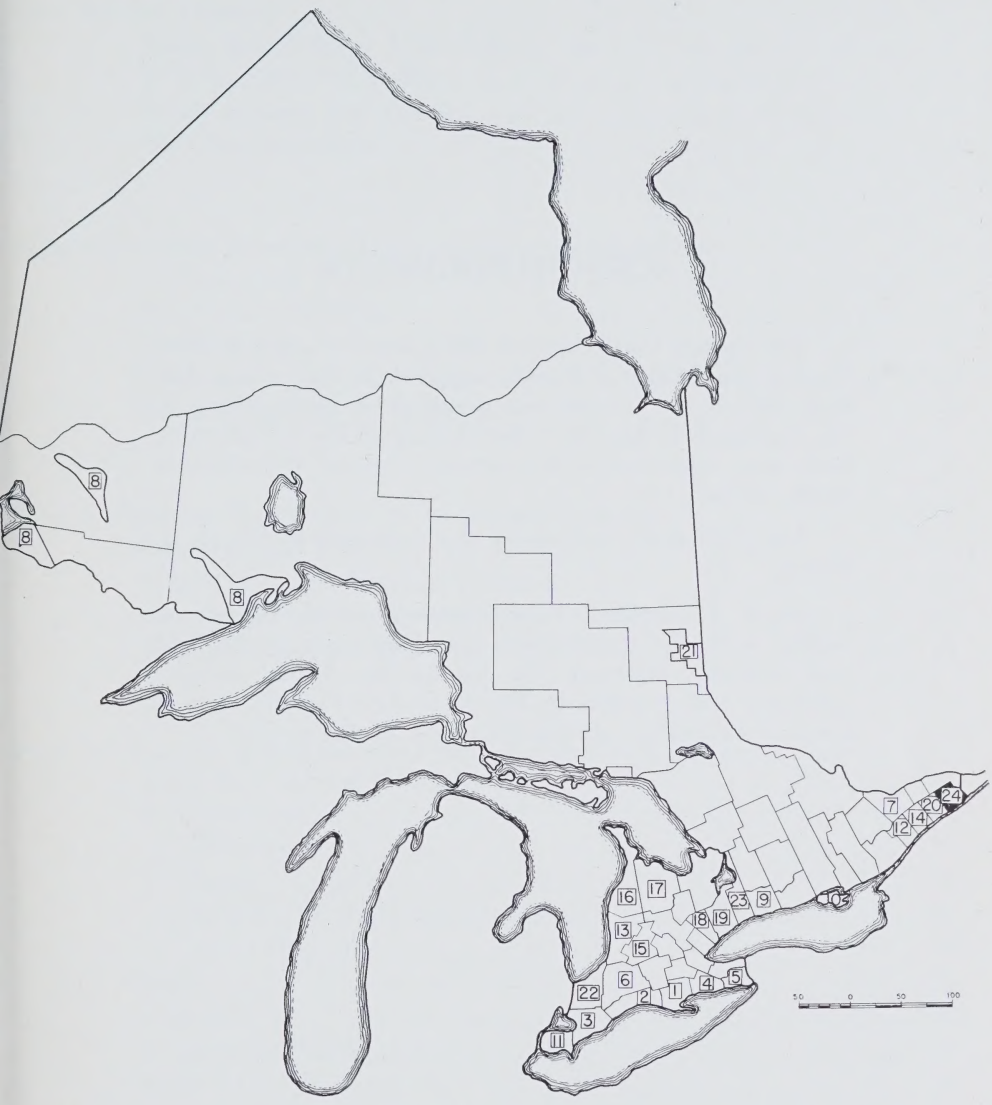

FIG. 1. Outline map of Ontario showing location of Glengarry County and other areas for which soil maps and reports have been published.

ACKNOWLEDGMENTS

The Canada Department of Mines and Technical Surveys, Surveys and Mapping Branch, supplied the base maps. The final copy of the soil map was prepared for lithographing by the Cartographic Section of the Division of Field Husbandry, Soils and Agricultural Engineering, Central Experimental Farm, Ottawa.

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Soil Survey of Glengarry County

by

B. C. Matthews, N. R. Richards *and* R. E. Wicklund

INTRODUCTION

The primary purpose of a soil survey is to classify and describe the soils of an area. Such features as colour, structure, texture, thickness, and number of horizons as well as some chemical characteristics are described for the different soils. Finally, some recommendations for land use are suggested. In seeking information regarding the soils of the area, reference should be made to the map as well as to the report. A total of twenty-eight soil types and phases occur in Glengarry County. This report and map point out the location of the different soils and indicate their crop adaptabilities and management requirements.

The Map — The soil map that is contained in the pocket at the back of the report presents all the important geographic features of the County such as cities, towns, railways, roads, post-offices, lakes, and rivers as well as the distribution of the soils. The areas of different soils are delineated by solid black lines and the soil types are identified on the map by the use of colours, letter combinations and symbols, the key for which appears on the map sheet. In using the map it must be kept in mind that the scale of the map (1 inch = 1 mile) prevents the presentation of sufficient detail to show soil variations of less than twenty-five acres in extent. However, the map and report, when properly used, can furnish valuable basic information for estimating the productivity and land use problems even within rather limited areas.

The Report — The report is divided into several sections as listed in the table of contents. Several tables of statistics in the text and in the appendix are presented to support statements made in the text of the report.

How to Use the Soil Survey Report

The individual reader may be interested in the whole report or only in some particular part. Ordinarily he will be able to obtain the information he needs without reading the whole report. The report is designed to meet the needs of three general groups of readers: (1) those interested in the County as a whole, (2) farmers and others interested in specific parts of the County such as a farm or concession and (3) students and teachers of soil science and related sciences.

Readers interested in the area as a whole include those concerned with agricultural advisory work, the location and development of urban centres, industries, highways, community co-operatives, processing plants and areas for forestry, wildlife, and recreation. Such persons should read the sections entitled *General Description of the Area*, in which location, organization, population, industries, transportation and markets are discussed, *Soil Problems in Glengarry County* in which physiography, relief and drainage, climate, and soil use problems are discussed, and *Land Use and Soil Management* in which soil improvement practices are suggested.

Readers interested in specific areas, i.e. a farm, or field, or group of farms, include farmers, agricultural fieldmen, prospective land buyers, realtors, tax assessors and

land appraisers. These readers should (1) locate on the map the tract of land with which they are concerned, (2) identify the soils in the tract by locating the appropriate symbol and colour in the legend on the map, and (3) read the descriptions of the specific soils in the section of the report entitled, *Description of Soils*. In this section each soil is described in detail and its suitability for use is discussed. Useful information will also be found in the section on *Land Use and Management*.

Students and teachers of soil science will find valuable information in the section on *Factors Affecting Soil Genesis in Glengarry County*. The *Summary of the Classification of the Soils of Glengarry County* along with the section on *Description of Soils* provides basic information for soil classification.

HOW SOILS ARE CLASSIFIED

The development of a soil from unweathered broken rock is an intriguing story. Under the influence of the vegetation, climate, and drainage acting on the raw soil material, called parent material, different soil layers develop over a period of time. Accordingly in a vertical cut through the soil, two or more layers or horizons may be observed above the grey parent material. The different soil horizons from the surface down to the parent material make up the soil profile.

Entire Soil Profile is Important

The entire soil profile must be considered in estimating the productivity of a given soil. Two soils, for instance, may have similar surface layers but one may have a compact subsoil that restricts water movement and root penetration, while the other may have an open porous subsoil that permits rapid water movement and easy root penetration.

In classifying soils, therefore, the entire soil profile is considered. In Glengarry County, twenty-eight different soils have been recognized and delineated on the map. These soils differ from one another in one or more of the following features of the soil profile; number, colour, thickness, texture, structure, and chemical composition of the different horizons.

In any given area of Glengarry County, there are two major groups of soil profiles — the well drained and imperfectly drained group, and the poorly drained group. In the well drained and imperfectly drained locations, the general appearance of the profiles differs greatly from place to place. Indeed, the best drained soils are the keys to the understanding of any given association of soils.

Well Drained Soil Profiles

Differences among well drained soils can be observed in different parts of the County. Because the climatic conditions and vegetation do not vary significantly within the County the observable differences in the well drained profiles can usually be related to the parent materials, especially to the lime content. In Glengarry County, there are three major great groups of well drained profiles, namely Brown Forest, Grey-Brown Podzolic, and Podzol. In addition, there are Ground-water Podzol soils (see Castor series description) and Organic soils (see Belmeade and Muck series descriptions).

Soils of Brown Forest Great Soil Group have Shallow Profiles and a Brownish Colour in the Subsoil.

The following is a description of a soil profile that represents the Brown Forest Great Soil Group in Glengarry County:

A_0 — ¼–0 inches of matted leaf litter.

A_1 — 0–5 inches of very dark grey loam; friable; medium crumb structure; few stones; medium to high in organic matter; pH — 7.0

B_1 — 5–10 inches of grey-brown loam; friable; fine nuciform structure; few stones; free carbonates may be present; pH — 7.0

B_2 — 10–18 inches of very dark grey-brown loam; friable; medium nuciform structure; stones and boulders; free carbonates may be present; pH — 7.2

A Grey-Brown Podzolic Soil Profile

C_1 — 18–23 inches of grey-brown loam; friable; very weak fine nuciform structure; stony calcareous; pH — 7.6

C_2 — Grey or grey-brown loamy calcareous till; stony; somewhat compacted; pH — 8.0

On a well drained site, where lime has been partially lost from the soil material (or where the material had only a medium lime content originally), the kind of profile that commonly occurs belongs to the Grey-Brown Podzolic Great Soil Group. The Kars gravelly sandy loam as described below is a good example of such a soil:

A_0 — ½–0 inches of leaf litter.

A_1 — 0–4 inches of dark grey-brown sandy loam; very fine crumb to single grain structure; few stones; pH — 6.8

A Podzol Soil Profile

A_2 — 4–12 inches of yellow-brown sandy loam; single grain structure; few stones; pH — 6.7

B — 12–20 inches of dark brown loam or sandy loam; small nuciform structure; few stones; pH — 7.0

C — Rough unsorted gravel and sand; low in carbonates; stony; some boulders; pH — 7.0

In well drained positions on materials that were originally low in lime or are so open in texture that leaching has rapidly removed the lime, a profile representative of the Podzol Great Soil Group has developed. The following is a description of a profile showing the characteristics of the Podzol group in Glengarry County:

A_0 — 1–0 inch of litter of twigs and needles.

Note dark grey surface soil and grey mottled subsoil of Dark Grey Gleisolic Soil

A_2 — 0–2 inches of grey sand; extremely friable; single grain structure; pH — 5.8

B_2 — 2–15 inches of dark brown sand; friable; single grain to very fine nuciform structure; pH — 6.4

C_1 — 15–22 inches of brownish yellow sand; friable; single grain structure; pH — 6.4

C_2 — Grey sand and gravel; non-calcareous; pH — 6.6

Poorly Drained Soil Profiles

In close association with each well drained profile, imperfectly drained and poorly drained profiles often occur on the lower slopes and in depressions. The imperfectly drained profiles exhibit the same kinds of horizons as the well drained profiles but the B horizon is mottled brown and reddish brown rather than a uniform

colour. The poorly drained soils, however, have a completely different set of horizons and are called "glei soils".

Commonly, the restricted drainage has far outweighed all other factors of soil development so that the same general kind of profile occurs in the poorly drained locations throughout the County. The poorly drained soils of Glengarry County are classified in the Dark Grey Gleisolic Great Soil Group. A description of a fine textured Dark Grey Gleisolic soil profile found in the County is presented below:

A_0 — ½–0 inches of matted leaf litter.

A_1 — 0–6 inches of very dark brown clay; friable consistency; crumb structure; high in organic matter which is well incorporated with the mineral fraction; no free carbonates; pH — 6.8

G_1 — 6–10 inches of grey clay; mottled with rusty brown; plastic consistency; massive structure; pH — 7.0

G_2 — 10–30 inches of mottled rusty brown and grey clay; extremely plastic; massive or very coarse blocky structure; no free carbonates; pH — 7.2

C — Grey clay; massive; plastic; pH — 7.2

The mottling that is evident in the G (glei) horizon is indicative of a fluctuating water table and the consequent alternate oxidation and reduction of the iron. In very poorly drained soils, the A horizon is mucky and the G horizons are more uniform drab grey colour. Such soils are included in the Organic Great Soil Group.

The differences in soils that are due to differences in drainage are usually observable within field or farm boundaries. Well drained, imperfectly drained, and poorly drained soils occur in close geographical association, so it is convenient to use the term "catena" to designate two or more soil series developed on similar parent material but differing in drainage.

Soil Type and Soil Series

The principal unit of soil mapping is the soil type. The soil type consists of a group of soils with profiles having similar genetic horizons, developed from similar parent material.

In using the map, it is important to keep in mind that a given soil type may include a limited range in properties. The boundaries between soil types vary in sharpness. Between two soil types in the field there is a zone that includes some of the features of each type. Also within a given type, there are often discrete areas of other types too small to be shown on the soil map.

Soil types do not occur at random, nor is their nature a matter of chance. The factors that have determined soil type differences in Glengarry County are discussed in Part II. If one knows the conditions under which a given soil type has developed, he will be able to obtain from the soil map a picture not only of the present character of the soil but also of the slope of the area where it occurs, the native vegetation, drainage, and other factors that have affected its formation.

Two or more soil types developed on similar parent material, under similar drainage conditions, but differing in texture of the surface horizon are grouped together as a Soil Series.

FIG. 2. Outline Map Showing Distribution of Soil Materials

In some instances, soil of a given type or series may possess physical features that limit its agricultural value; hence phases of a soil type or soil series are mapped. For example, a physical characteristic such as stoniness or topography may drastically change the agricultural value of a soil without altering the profile chracteristics sufficiently to place it in another soil type; hence phases of soil types have been mapped to delineate areas that have special problems for agricultural use.

SALIENT FACTORS AFFECTING USE AND PRODUCTIVITY OF SOILS IN GLENGARRY COUNTY

A soil survey provides a sound basis for a program of improved land use and soil conservation. All of the important factors of soil and climate are discussed later in the report. A brief resumé of these factors in relation to crop production is presented here as an introduction to the soils of Glengarry County.

Soil Parent Material

The effects of soil parent material on the type of soil developed are discussed in Part II. Parent material, i.e. the material from which the soil developed, is a fixed characteristic that the farmer cannot alter. Success in crop production depends on the ability of the farmer to adapt his cropping practices to make the best of the soils he has. In Table 1, the kinds of parent material and the important features of the soils are given.

TABLE 1

ACREAGES AND IMPORTANT FEATURES OF SOILS DEVELOPED FROM DIFFERENT PARENT MATERIALS

Parent Material	Acreage	% Total Acreage	Important Features of Soils
Glacial Till	127,400	42.0	Medium fertility; rich in lime; often stony; some erosion susceptibility.
Glacio-fluvial gravel	7,600	2.4	Coarse texture; medium to low fertility; stony; subject to erosion.
Outwash sands	12,000	3.9	Coarse texture; low to medium fertility; low moisture-holding capacity.
Lacustrine fine sands and silts	32,400	10.6	Medium to fine texture; difficult to drain; stonefree.
Lacustrine silts and clays	82,100	26.5	Fine texture; stonefree; high fertility; tendency to bake when dry; inadequate natural drainage.
Alluvial	19,400	6.4	Flood land along stream courses of variable texture and fertility; subject to seasonal flooding.
Organic	25,000	8.2	Partially decomposed plant remains; poorly drained; underlain by clay or sand.
Total	305,900	100.0	

More than forty per cent of Glengarry County is glacial till material that develops a medium textured soil well suited for general farming. The erosion hazard is not serious in view of the large acreage in hay and pasture for the dairy cattle.

Texture

There is a wide variation in texture of the surface soils of the County. The acreages in the different textural groups are shown in Table 2.

TABLE 2

APPROXIMATE ACREAGE OF SOILS OF DIFFERENT TEXTURAL CLASSES IN GLENGARRY COUNTY

Textural Classes	Acreage	% Total Acreage
Sand, sandy loam	13,600	4.7
Fine sandy loam	10,200	3.3
Loam	129,300	42.1
Silt loam, silty clay loam	42,600	13.9
Clay loam, clay	65,900	21.6
Total	261,600	

In general the soils of coarse texture, sands and sandy loams, contain fewer plant nutrients and are less capable of holding moisture than the finer textured soils. The medium textured soils (loams, and silt loams) in Glengarry County are fairly high in fertility and usually have fairly good drainage. Such soils are capable of producing a wide range of crops. The fine textured soils are generally level and inadequately drained. Tile drains and open ditches are required to bring these soils into satisfactory production.

Climate

The climate of Glengarry County is suitable for general farm crops. The temperature is usually too low during winter for the survival of winter wheat. Rainfall distribution, length of growing season, and average temperature during the growing season are satisfactory for many of the common farm crops.

Features that can be Modified

The three factors, parent material, texture, and climate mentioned above cannot be altered or controlled by the landowner or operator. There are, however, several factors affecting soil productivity that can be altered. A knowledge of the limiting features of the soil is essential before a planned program of good land use can be carried on. The following paragraphs describe the major alterable features of the soils that limit production and include recommendations for overcoming the limitations.

The knowledge of soil management in any given area has been accumulated over the generations often by the system of trial and error. Soil scientists are now seeking to learn which management practices are good and which new ones should be adopted. This section is concerned with the factors of the soil with no regard to factors foreign to the soil, such as disease, economics, and weather.

Drainage — Approximately 60% of the soils in Glengarry County have a drainage problem in some degree.

TABLE 3

ACREAGES OF DIFFERENT SOIL DRAINAGE CLASSES IN GLENGARRY COUNTY

Drainage Class	Acreage	% of Total
Well Drained	129,400	43.2
Imperfectly Drained	21,000	6.9
Poorly Drained	111,100	36.3
Very Poorly Drained	44,400	14.6
Total	305,900	100.0

About 15% of the County is very poorly drained and for much of this land reclamation for general farming is too costly at the present time. Most of the poorly drained soils are fine textured and high in fertility. The subsoil is often relatively impermeable.

Open ditches should be installed and existing ones should be kept clean. Where outlets are available, tile drainage will improve the growth of deep rooted legumes. In turn the legumes will improve those soils in which the impeded drainage is a result of an impervious subsoil. There is a need for investigational work to determine the most effective means of overcoming the drainage problem in Glengarry County to improve the reliability and versatility of the soils.

As shown in Table 3 more than 40% of the soils in the County are well drained. Wherever these soils are interspersed with imperfectly or poorly drained soils, the latter become of greater value in producing pasture and hay while the well drained soils produce the cereal grains and intertilled crops. A number of farms, however, particularly in Lancaster Township in the south-east part of the County have no well drained land; hence, artificial drainage becomes a necessity.

Stoniness and Erosion — The problem of excessive numbers of stones is a physical one that is especially important in the townships of Kenyon, Lochiel, and Charlottenburg. In many instances the soil is excellent for agriculture except for the stones and boulders. It is impossible to make a general statement as to the advisability of stone removal. The cost of removing the stones must be charged against the resultant increase in returns. Parts of the area have been cleared of stones and are producing good crops. Even if the stones are not removed, the land can be used for permanent pasture production.

Along with the stoniness problem, there is an erosion hazard in these Townships. Contour cultivation and strip cropping is advisable on some of the slopes.

Fertility — Although soils vary in their supplies of plant nutrients before cultivation, none of them will produce abundant crops for any extended period of time without supplemental fertilization. Cultivation also speeds up the decay of soil organic matter so constant additions of organic material as crop residues, green manure and farmyard manure are essential. Phosphorus is the plant nutrient most commonly deficient but in most instances complete fertilizers should be used. The most satisfactory basis for fertilizer recommendations is a soil test. Such tests can be obtained at the Kemptville Agricultural School.

Sub-marginal Cropland

Approximately 20 per cent of the land area of Glengarry County is sub-marginal cropland. The flood land along stream courses is generally devoted to permanent pasture and is especially valuable for this purpose during dry summer months.

The muck soils in the County have not been developed for agriculture. The distance to larger centres of population minimizes the value of the muck land for the production of truck crops.

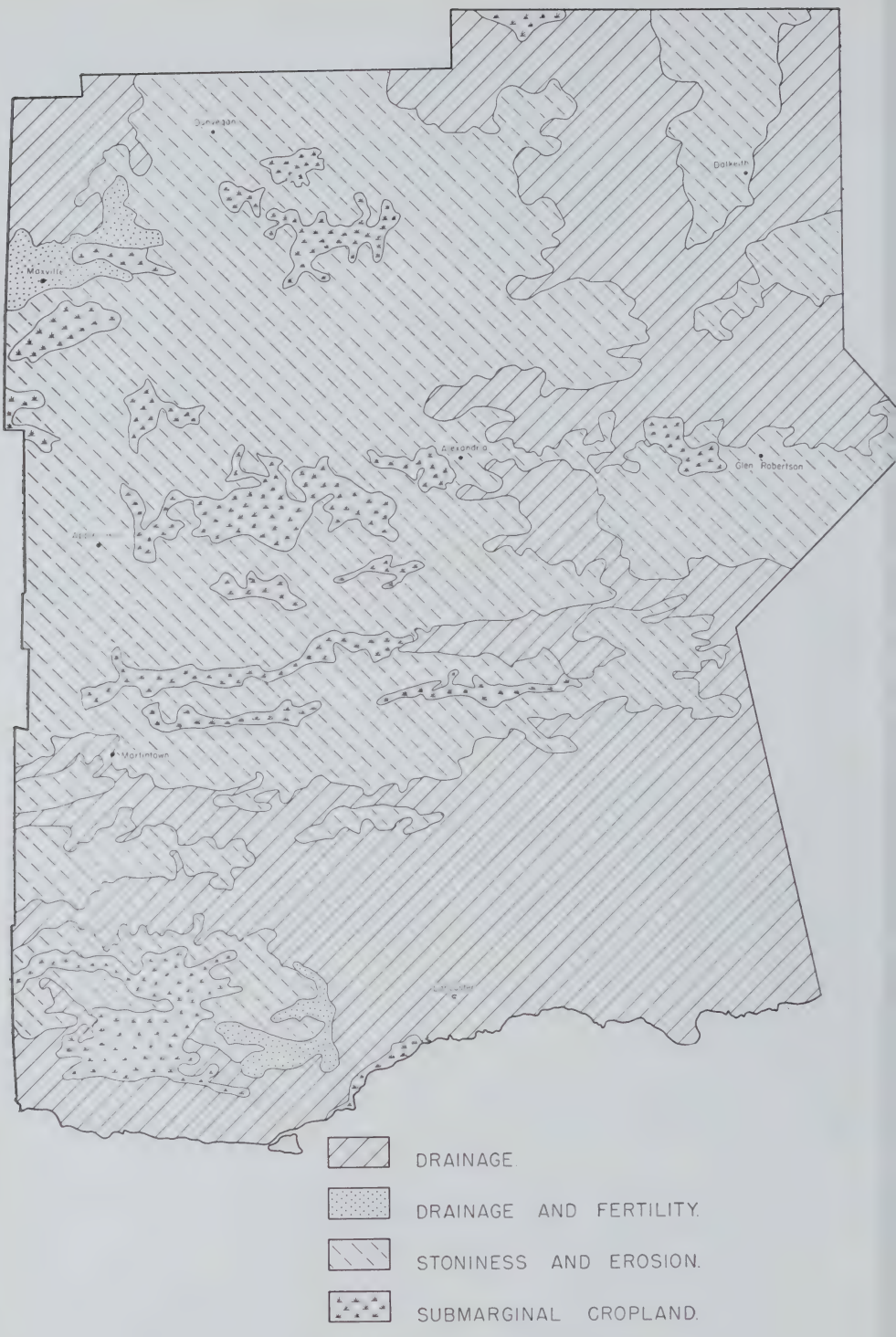


FIG. 3. Outline Map Showing Major Land Use Hazards

PART I

GENERAL DESCRIPTION OF GLENGARRY COUNTY

Location and Area

Glengarry County is located in Eastern Ontario on the north shore of the St. Lawrence River. It is bounded on the west by Stormont County and on the north by the County of Prescott. The Province of Quebec borders the eastern side. The County is situated about equidistant from Ottawa and the city of Montreal, Quebec.

The total area of Glengarry County is approximately 478 square miles—(305,920 acres). According to the 1951 Census of Canada, 264,383 acres or about 90 per cent of the total area is occupied farm land. The remaining 10 per cent is taken up by towns and villages, road allowances, muck bogs, etc.

County Seat and Principal Towns

The city of Cornwall, in Stormont County, is the County seat for the United Counties of Dundas, Stormont, and Glengarry. Alexandria, with a population in

The lake and park at Alexandria is a popular recreation area.

1951 of 2,204 is the only incorporated town in Glengarry County. It is situated in the central part of the County at the junction of Highways 34 and 43. The office of the Agricultural Representative is located there. Alexandria is the educational and recreational centre for a large portion of Glengarry County.

Among the more important villages serving the rural population are Maxville (population 778); Lancaster (population 548); Glen Robertson, and Dalkeith. A

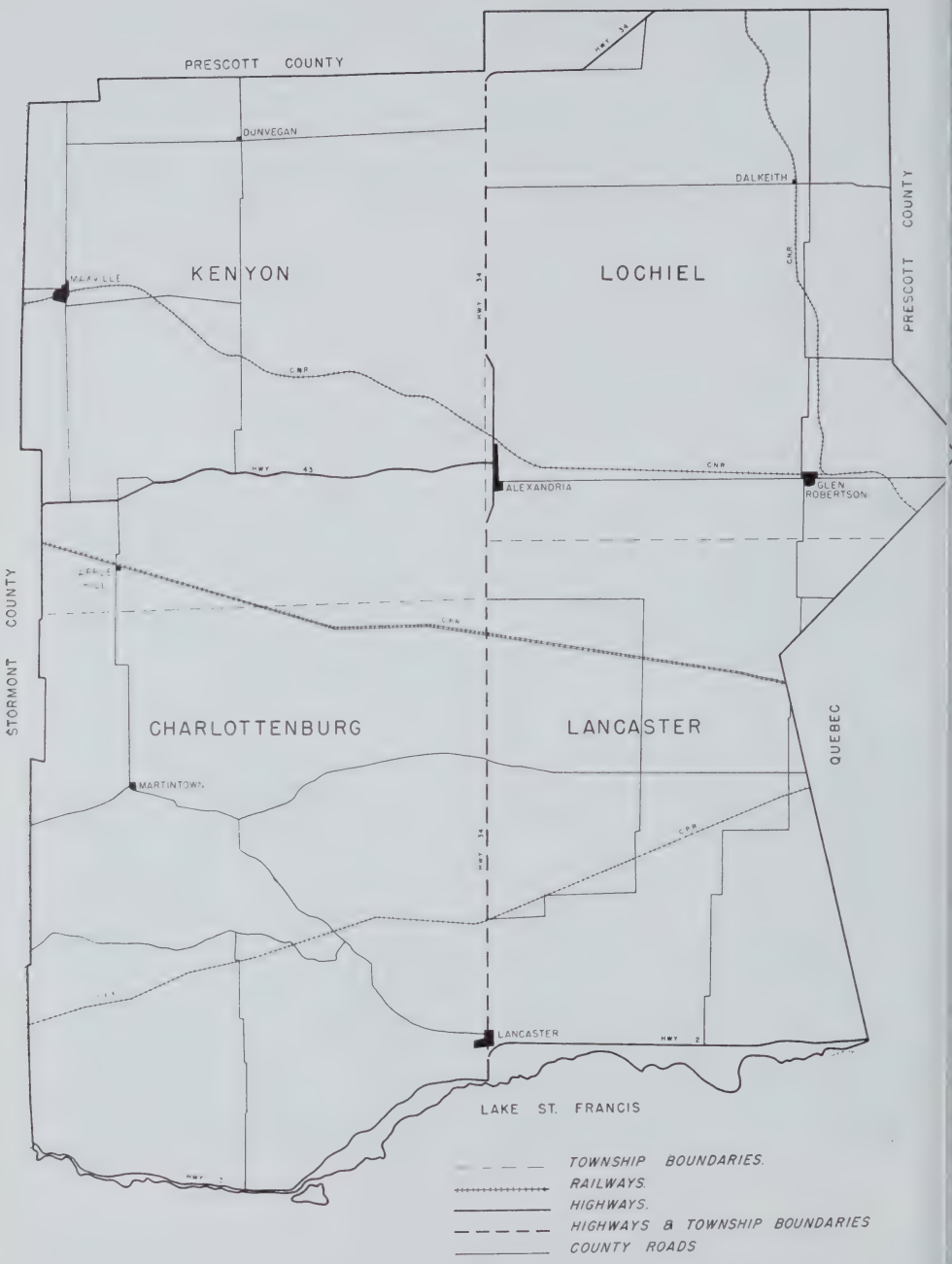


FIG. 4. Outline Map Showing Townships and Principal Centres

Dominion Government Illustration Station is situated near Williamstown in Charlottenburg township.

Glengarry County, typical of the cheese making areas of Eastern Ontario, has many small hamlets serving local communities. With a cheese factory and often a small general store and service station, centres like Laggan and Glenroy form an important part of the agricultural organization in the County.

Population and Racial Origin

According to the 1951 Census, the total population of Glengarry County was 17,702. Approximately 80 per cent, 15,498 people, were classified as rural dwellers. The remaining 20 per cent were classed as urban population and lived in the incorporated centres of Alexandria, Maxville, and Lancaster.

The figures in Table 4 indicate the trend of the population changes since 1851.

TABLE 4

POPULATION OF GLENGARRY COUNTY

Year	Rural Population	Urban Population	Total
1851			17,596
1861			21,187
1871			20,524
1881			22,221
1891			22,447
1901	18,888	3,243	22,131
1911	17,553	3,706	21,259
1921	16,926	3,592	20,518
1931	15,275	3,391	18,666
1941	15,069	3,663	18,732
1951	15,498	2,204	17,702

A marked decrease in the total population since 1901 is indicated by the above data. This decrease has occurred in the rural population. The minor fluctuations in the relatively small urban population did not contribute appreciably to the net change.

Most of the early history and development of Glengarry County can be attributed to the Scottish settlers. Modern statistics show, however, that a majority of the present residents of the County are of French descent. Classification according to racial origin is given below.

	1911	1941	1951
Total population	21,259	18,732	17,702
Canadians of British origin—Scottish	10,484	6,298	7,196
—Irish	977	985	
—English	815	936	
Canadians of French origin	8,710	10,121	10,055
Canadians of other origins	273	392	451

Transportation and Markets

Glengarry County is well supplied with roads and railways connecting the various parts of the County, and connecting the County with other parts of Ontario and Quebec.

Highway No. 2 passes through the front of the County along the St. Lawrence River, forming a link with Montreal and the Province of Quebec on the east and joining with the remainder of Southern Ontario to the west.

Highway No. 34 traverses the County from south to north. Running from Lancaster through Alexandria, this modern, well kept highway joins at Hawkesbury with Highway No. 17 to Ottawa and Montreal.

An alternate route to Ottawa is provided by Highway 43 from Alexandria west to Highway 31.

A network of County and township roads serves the needs of all parts of Glengarry County. However, many are not well surfaced due to the scarcity of suitable large gravel deposits.

The County has excellent rail connections with Quebec and the rest of Ontario. The main line of the C.N.R. from Toronto to Montreal, passes through Lancaster. The main line of the C.P.R. passes through Apple Hill and Green Valley in the central section of the County. Maxville, Greenfield, Alexandria, and Glen Robertson are served by the Ottawa to Montreal line of the C.N.R. A branch line of the C.N.R. runs north from Glen Robertson to Hawkesbury in Prescott County. Considerable fluid milk from Lancaster and Charlottenburg townships is carried by C.P.R.'s branch line from Montreal to Cornwall.

These rail and road connections supply adequate facilities for the marketing of the County's produce.

PART II

FACTORS AFFECTING THE FORMATION AND DEVELOPMENT OF THE SOILS OF GLENGARRY COUNTY

A knowledge of the soils of an area requires some knowledge of the factors that cause soil differences. The most important of these factors are: (1) soil parent material, i.e. the kinds of materials from which the soils have developed, (2) relief, i.e. the surface features of the land, the drainage conditions, etc., (3) climate which influences the kind and intensity of weathering and leaching of the soil material, (4) vegetation which affects the content of organic matter in the soil, (5) soil age, i.e. length of time weathering forces have been acting on the soil materials. In any given location, all of the factors are operative but usually one factor is dominant over the others. Thus the character of some soils is determined mainly by the character of the material from which they have developed, while in other soils, parent material is of minor influence and the properties of the soils are to a large extent governed by conditions of relief.

Soil Materials

This part of North America was subjected to at least three glaciations. However, only the surface deposits or those of the last (Wisconsin) glaciation influence the soils of Glengarry County.

The movement of the ice was generally in a north-south direction although in the southern part of the County the drumlins (elongated rounded ridges) roughly parallel the St. Lawrence River valley, indicating that the ice advanced locally from the north-easterly direction. Following the recession of the ice, an arm of the sea, named Gilbert Gulf, entered this area. During this period many of the fine particles were washed from the ridges leaving the boulders. As the ice retreated farther the land commenced to rise and eventually came above sea-level.

Most of Glengarry County is underlain by limestone of the Trenton and Black River formations. Some Beekmantown dolomite occurs in the north-eastern part of Lochiel Township. Along the St. Lawrence River and inland in Lancaster Township, the underlying bedrock is chazy limestone. The Trenton limestone is readily broken up and, therefore, is generally covered with a good depth of till. There is very little rock outcrop in the County.

A more complete discussion of the bedrock formations of the area has been written by Chapman and Putnam.*

Although the soil materials have been transported, they do bear some relation to the surface rock formation. The Trenton limestone is dominantly calcium carbonate but has a rather high percentage of insoluble matter.

The dominant chemical characteristics of the underlying bedrock is reflected in the soils which have a high content of calcium carbonate.

Another factor that affects the soil parent materials is the mode of deposition. Materials of two general groups occur in Glengarry County: (1) unsorted tills laid

*Chapman, L. J. & Putnam, D. F., The Physiography of Eastern Ontario, Sci. Agr. 20:7, 1940.

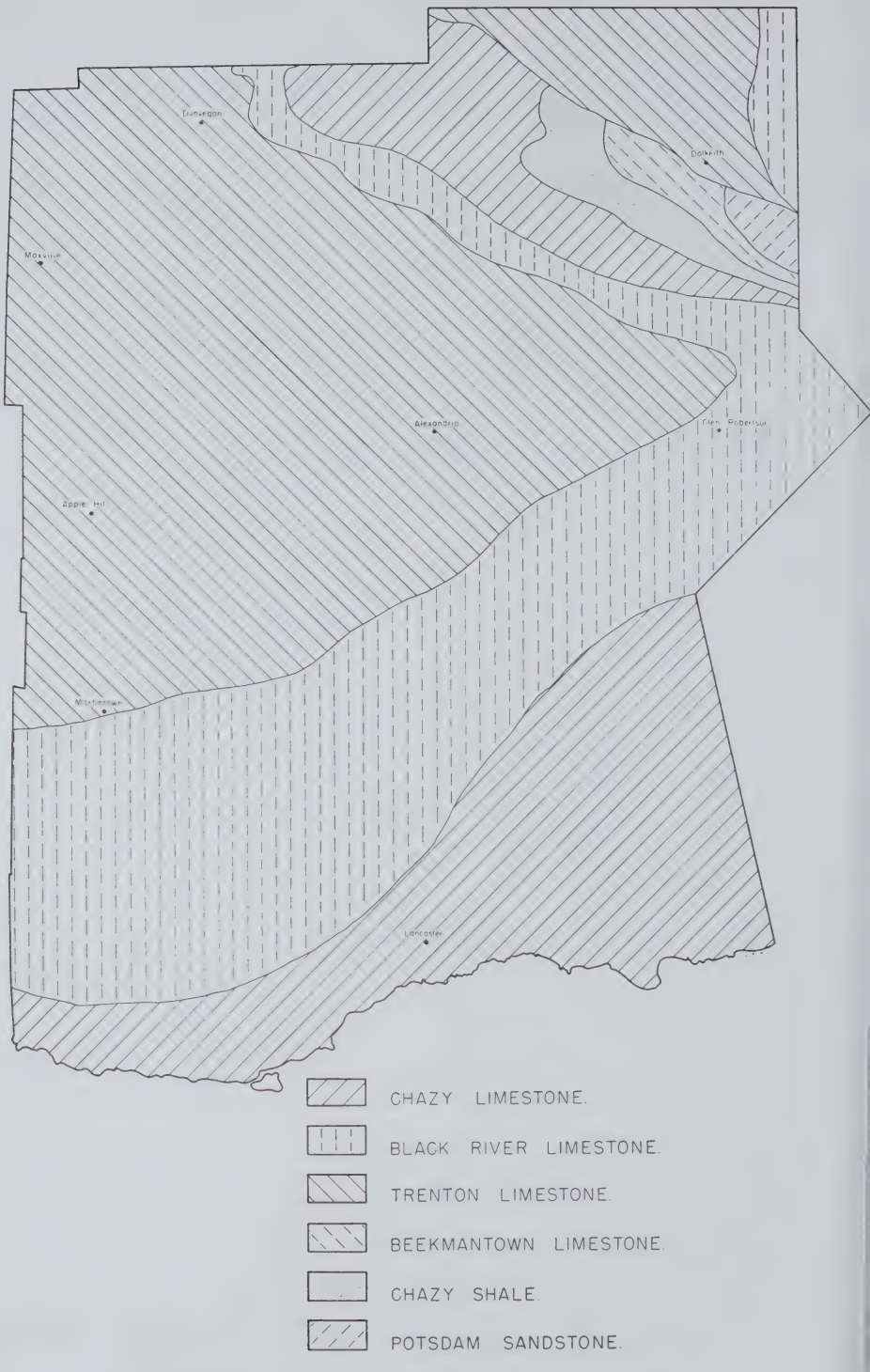


FIG. 5. Outline Map Showing Bedrock Geology

down by ice, (2) sorted clays, silts, sands and gravels deposited by water. The tills are further differentiated on the basis of size and kind of stones and the kind of fine material between them. The water-laid materials are grouped according to the size of the particles.

After the ice sheet disappeared from the area a deposit of till of varying depth remained over the Trenton limestone bedrock. Much of the till was left arranged in the form of long oval shaped hills (drumlins) whose long axes are roughly parallel to the direction of movement of the glacier. Soils developed on till are generally good agricultural soils characterized by rolling topography, with some stones throughout the profile.

A large portion of the area consists of water-laid material, an indirect result of glaciation. During the recession of the ice, meltwaters rushed in streams through crevasses in the ice and deposited coarse gravel and sand that remain today as long narrow ridges called "eskers". These ridges provide a good source of road gravel.

Extensive areas of medium sand materials also occur. Such material was deposited by moving water as it slowed down and flowed out over the area in front of the glacier. The topography is usually level to slightly undulating. As the ice receded and the waters of Gilbert Gulf and Champlain Sea covered the area much sediment was formed in the depths of these post-glacial waters. The sediment is fine textured, and stonefree. It is less alkaline than the till and generally is inadequately drained, partly because of its level topography.

Till Deposits

The till deposits are made up of stones, dominantly limestone with some sandstone and Precambrian rocks ranging in size from very fine grit to large boulders scattered throughout a matrix of sand, silt and clay in varying proportions. The till area is generally smooth gently sloping but in the southern part of the County the topography is moderately to steeply sloping. In Kenyon and Lochiel Townships the till is calcareous and stony and contains some sandstone fragments. Numerous Precambrian rocks are scattered over the surface. In the southern part of the County, however, the till is more highly calcareous and contains less sandstone.

Gravelly Deposits

Long narrow ridges of gravelly material occur throughout the County particularly in association with the till materials. This material was deposited in the beds of glacial streams and it ranges from fine sand to large boulders.

Deposits of Water-laid Sediments

Water-laid sediments range in texture from sand to clay and are typically stonefree.

(a) *Coarse textured material*

There is only a limited area of sand plains in Glengarry County and these are in association with the gravel ridges. The topography is level to undulating.

Sand deposits occur near Maxville and St. Elms. Along the banks of the Raisin River acidic fine sands occur in small areas. All of the sand plains are underlain by clay usually within ten feet or less of the surface. Hence, around the periphery of the sand areas there is often an area of shallow sand over clay.

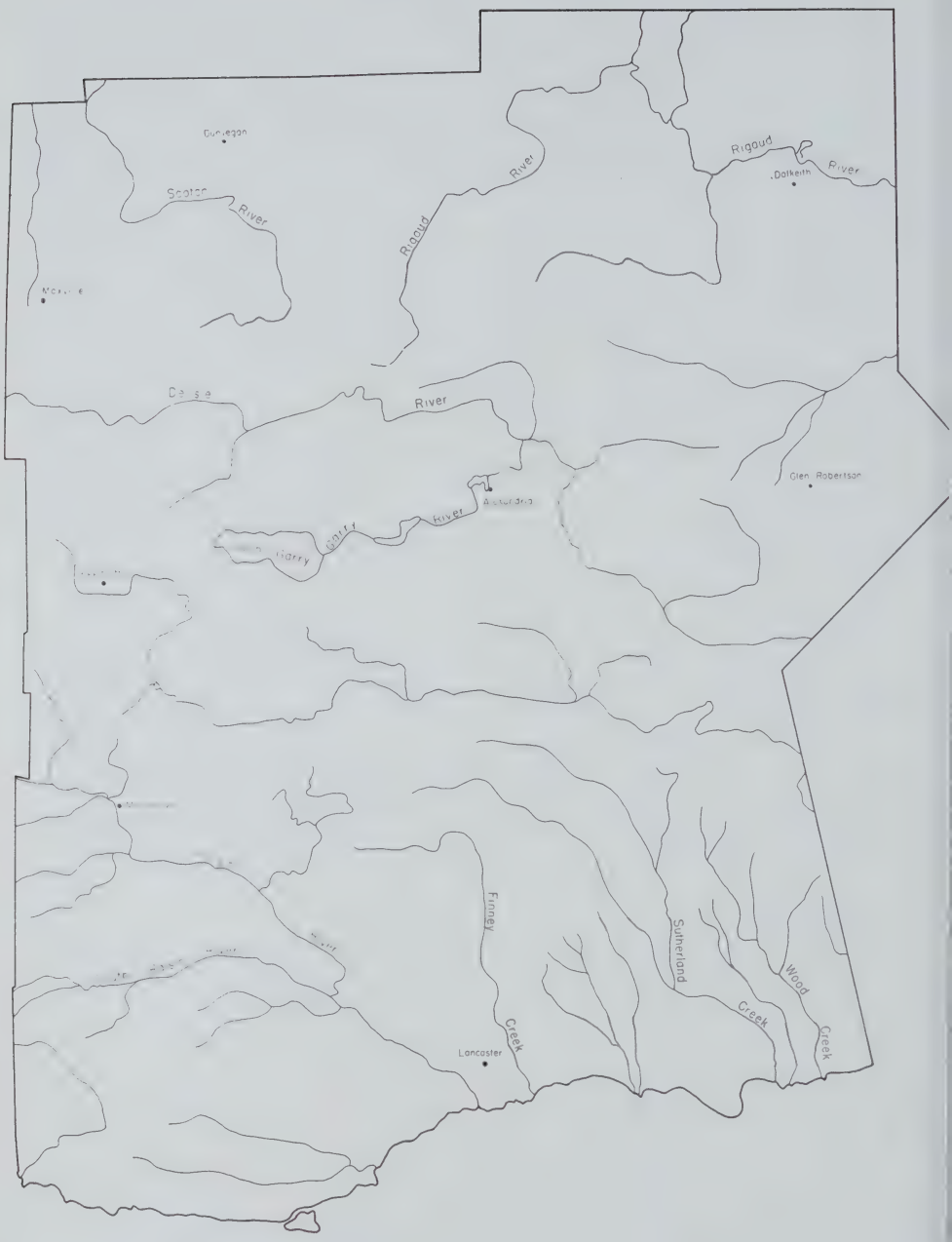


FIG. 6. Outline Map Showing Drainage Systems

(b) *Medium textured materials*

Along the St. Lawrence River from Summerstown to the Quebec border and extending inland for four to six miles, there is a fairly continuous area of stratified fine sand and silt underlain by clay. These stonefree materials were deposited as sediments in the Champlain Sea during the later stages of its existence or as alluvium of the St. Lawrence River. The topography is level.

(c) *Fine textured materials*

Water-laid clays and silts deposited in the Champlain Sea occupy 29.6% of Glengarry County. The clays in the northern part of the County are irregularly stratified brown and grey and contain less lime than the grey clays in the southern part. The uniform grey clays occur in Charlottenburg township and in extensive areas in Lancaster Township. The topography is level. Drainage improvement is necessary for maximum crop production.

Muck Deposits

The surface layer of the muck deposits is largely of organic origin, the material being in various stages of decomposition. In most instances, the muck is underlain by clay although grey sand or loam till may be found in some areas.

Relief

Glengarry County is characterized as a region of modest relief. The maximum elevation is slightly over 375 feet above sea level, and occurs just south of Maxville at the western edge of the County. The height of land runs roughly parallel to the St. Lawrence River and has an elevation at Brodie, near the eastern boundary, of about 275 feet above sea level. The elevation along the banks of the St. Lawrence to the south is about 150 feet above sea level.

Two distinct kinds of topography occur in the County. The till plains which cross the County diagonally from south-west to north-east exhibit an undulating to gently rolling relief with occasional steeper slopes on the drumlins in Charlottenburg township. In contrast to this, the clay plains to the east and the fine sand and silt plains to the south present a level to very gently sloping landscape, broken only by a few till ridges protruding above the water-laid sediments.

The low relief has a marked influence on the drainage pattern of the County and on the extent of soil erosion losses.

To the north of the drainage divide, the Scotch River and tributaries of the Caledonia Creek drain by way of the Nation River to the Ottawa River. The Rigaud River and its branches, which empties into the Ottawa River beyond the Quebec border is the drainage channel for part of Kenyon and the northern half of Lochiel townships. To the south of the divide the drainage is to the St. Lawrence River by way of the Raisin, Delisle and Beaudette Rivers and a number of other smaller streams. Many of these drainage ways have little fall and flow sluggishly through most of the year.

Climate

Glengarry County is in the Eastern Ontario climatic region of Southern Ontario as classified by Putnam and Chapman*. The mean annual temperature is 42° F as

*Putnam, D. F. and L. J. Chapman, The Climate of Southern Ontario, Sci. Agr. 18:8, April, 1938.

Sugar Maple and Beech predominate on well drained soils in Glengarry County.

Elm is the common tree cover on poorly drained soils in Glengarry County.

compared with 44° at Guelph, 45.3° at Brantford and 32° at Kapuskasing. The extreme low temperature recorded for the area is —44° F while the extreme high is 104° F. The average date of the last frost in the spring is between May 11-24 with 130 to 140 days in the frost-free period. The average length of the growing season is 191 to 197 days.

The precipitation varies from 34-40 inches annually. About 17-18 inches of rain fall on the average during June, July and August, an amount that is adequate for most farm crops. Drought frequency is low.

Natural Vegetation

During the time that it is becoming established, vegetation is dependent on climate and soil conditions. However, when it is established, vegetation exerts a strong influence on the type of soil developed. The types of litter found under coniferous and decidous forests are quite different in chemical composition, consistency, and ease of decomposition.

It is impossible to determine which features of the soils of Glengarry County have been influenced by vegetation only, because all the other soil forming factors have been operating simultaneously. Indeed, it is difficult to determine the native vegetation on certain soil types because only about eight per cent of the area is wooded under present land use. Certain associations of trees, however, have been observed to occur on certain soil areas more often than others.

The upper St. Lawrence Section of the Great Lakes-St. Lawrence Forest Region as described by Halliday includes the County of Glengarry.

The general character of the tree cover is broad leaved but there is a fair representation of coniferous growth. The dominant association on well drained sites is sugar maple and beech with small numbers of birch, ash, and elm. Hemlock, white spruce and pine occur on the light soils. In poorly drained areas elm dominates along with tamarack, white cedar and black ash. Clumps of cedar are characteristic of stony sites.

Time

The influence of time as a soil forming factor is well expressed in the soils of Glengarry County. The soils of this County, like those of all Eastern Ontario, are young in comparison with the soils of the remainder of Southern Ontario. At the time of the last, or Wisconsin glaciation, the weight of the ice mass compressed the earth's crust so that much of Ontario was below the level of the sea. As the recession of the glacier came about the glacial drift was exposed and the processes of soil formation began to act. However, the ice left Eastern Ontario late in the recession, and this low lying land then was inundated for considerable time by the post-glacial Champlain Sea. It has been estimated that the soil materials of this area have been exposed for from 4,000 to 8,000 years. In comparison, most of Western Ontario has been free of ice and inundation for at least 15,000 years.

A youthful soil is characterized by an immature profile with a relatively shallow solum. These characteristics are typical of Glengarry County soils. Undifferentiated soil materials are commonly found at depths of fifteen to thirty inches, depending upon their nature and physiographic position. Some of the well drained coarse sands are weathered to a depth of three feet or greater. The relative youth of the soils, along with the calcareous nature of the parent materials, is largely responsible for the predominance of the Brown Forest soils in the County.

PART III

CLASSIFICATION AND DESCRIPTION OF GLENGARRY COUNTY SOILS

Although knowledge of the factors that have affected the development of the soils of Glengarry County is interesting, it is of little help in planning the efficient use of the soils as they exist today. It is the purpose of this part of the report to present a detailed description of each soil type with regard to its profile features as well as other features of significance to the agricultural use of the soil.

Summary of the Classification of the Soils of Glengarry County

	Acreage	% of Total
A. Soils Developed from Till		
(1) Brown Forest soils		
(a) Well drained		
(1) Eamer Series		
(a) Eamer loam (El)	48,300	15.8
(b) Eamer loam-bouldery phase (El-b)	3,400	1.1
(2) Grenville Series		
(a) Grenville loam (Gl)	65,800	21.5
(b) Grenville loam-shallow phase (Gl-s)	4,200	1.4
(b) Imperfectly drained		
(1) Matilda series		
(a) Matilda loam (Ml)	5,800	1.9
(2) Dark Grey Gleisolic soils		
(a) Poorly drained		
(1) Lyons Series		
(a) Lyons loam (Ll)	1,800	.6
B. Soils Developed from Roughly Stratified Sand and Gravel		
(1) Grey-Brown Podzolic soils		
(a) Well drained		
(1) Kars Series		
(a) Kars gravelly sandy loam (Ksl)	7,600	2.5
C. Soils Developed from Sorted Outwash Materials		
(1) Medium Sand		
(a) Podzol soils		
(1) Well drained		
(a) Uplands Series		
(i) Uplands sandy loam (Usl)	200	.1
(2) Imperfectly drained		
(a) Rubicon Series		
(i) Rubicon sandy loam (Rsl)	3,000	1.0
(b) Dark Grey Gleisolic soils		
(1) Poorly drained		
(a) Granby Series		
(i) Granby sandy loam (Gsl)	1,300	.4

	Average	% of Total
(2) Fine sand		
(a) Podzol soils		
(1) Well drained		
(a) St. Thomas Series		
(i) St. Thomas fine sandy loam (Tfsl)	100	.1
(2) Imperfectly drained		
(a) L'Achigan Series		
(i) L'Achigan fine sandy loam (Afsl)	3,100	1.0
D. Soils Developed from Sorted Outwash Underlain by Lacustrine Material		
(1) Soils formed from sand underlain by clay low in lime		
(a) Dark Grey Gleisolic soils		
(1) Poorly drained		
(a) Allendale Series		
(i) Allendale sandy loam (Asl)	1,500	.5
E. Soils Developed from Deltaic Fine Sands and Silts		
(1) Ground-water Podzol soils		
(a) Imperfectly drained		
(1) Castor Series		
(a) Castor very fine sandy loam (Cvfsl)	6,600	2.1
(b) Castor very fine sandy loam-shallow phase (Cvfsl-s)	400	.1
(c) Castor silt loam (Csil)	300	.1
(2) Dark Grey Gleisolic great soil group		
(a) Poorly drained		
(1) Bainsville silt loam (Bsil)	19,200	6.3
F. Soils Developed from Deltaic Fine Sands and Silts Underlain by Lacustrine Clay within three feet		
(1) Dark Grey Gleisolic soils		
(a) Poorly drained		
(1) Marionville Series		
(a) Marionville silt loam (Msil)	6,900	2.2
G. Soils Developed from Lacustrine Materials		
(1) Silt loam		
(a) Dark Grey Gleisolic soils		
(1) Poorly drained		
(a) Osgoode Series		
(i) Osgoode silt loam (Osil)	14,700	4.8
(ii) Osgoode silty clay loam (Osicl)	1,500	.5
(2) Grey clay, slightly calcareous		
(a) Dark Grey Gleisolic soils		
(1) Poorly drained		
(a) North Gower Series		
(i) North Gower clay loam (NGcl)	13,400	4.4
(ii) North Gower clay (NGc)	7,600	2.5
(3) Stratified Brown and Grey Clay		
(a) Grey-Brown Podzolic soils		
(1) Imperfectly drained		
(a) Wendover Series		
(i) Wendover clay (Wc)	1,800	.6
(b) Dark Grey Gleisolic soils		
(1) Poorly drained		
(a) Bearbrook Series		
(i) Bearbrook clay (Bc)	41,400	13.5

	Average	% of Total
(4) Grey clay, non-calcareous		
(a) Dark Grey Gleisolic soils		
(1) Poorly drained		
(a) Ste. Rosalie Series		
(i) Ste. Rosalie clay (Rc)	1,700	.5
H. Soils Developed from Organic Material		
(1) Shallow underlain by clay		
(a) Organic great soil group		
(1) Very poorly drained		
(a) Belmeade Series		
(i) Belmeade muck (Bm)	2,400	.8
(2) Deep Organic Deposits		
(a) Organic great soil group		
(1) Very poorly drained		
(a) Muck (M)	22,600	7.4
I. Soils Developed from Recent Alluvium		
(1) Flood land along stream courses		
(a) Alluvial great soil group		
(1) Bottom Land (B.L.)	19,400	6.3

Those who need to become familiar with all of the soil types in the County will find it helpful to understand the relations between the different soil types. Table 5 will help to make these relations clear. Soil types that appear in the same vertical column and between two horizontal double lines generally present similar problems in land use.

DESCRIPTION OF GLENGARRY COUNTY SOILS

A. Soils Developed on Till

The loam textured till materials found in Glengarry County may be divided into two groups on the basis of the carbonate content. The moderately calcareous till was derived from Black River limestone predominantly, while the highly calcareous till is underlain by Trenton limestone.

The Grenville catena includes the medium textured soils developed on those sections of the till plain underlain by Black River formation. The Grenville catena consists of the well drained Grenville series, the imperfectly drained Matilda series and the poorly drained Lyons series. The well drained soils developed on Trenton limestone materials are classified as the Eamer series. The imperfectly and poorly drained associates of the Eamer series have not been separated from the corresponding members of the Grenville catena.

Grenville Series (80,000 acres)

The Grenville series is developed from morainic material that, in Glengarry County, is underlain predominantly by limestone of the Black River formation. The topography on which the series developed is undulating to slightly rolling. On the gentler slopes, areas of imperfect drainage having soil similar to Matilda loam may

TABLE 5

GLENGARRY COUNTY SOILS GROUPED ACCORDING TO TEXTURE PARENT MATERIAL AND DRAINAGE*

Texture of Surface Soil	Parent Material	Well Drained	Imperfectly Drained	Poorly Drained
Coarse	gravel, medium lime	Kars gravelly sandy loam		
	medium sand, low lime	Uplands sandy loam	Rubicon sandy loam	Granby sandy loam
	medium sand over clay			Allendale sandy loam
	fine sand, low lime	St. Thomas fine sandy loam	L'Achigan fine sandy loam	
Medium	glacial till, high lime	Grenville loam	Matilda loam	Lyons loam
		Grenville loam-shallow ph.		
	glacial till, very high lime	Eamer loam		
		Eamer loam-bouldery phase		
Medium to fine	very fine sand and silt		Castor very fine sandy loam	Bainsville silt loam
			Castor very fine sandy loam-shallow phase	
			Castor silt loam	
	silt			Osgoode silt loam
				Osgoode silty clay loam
Fine	silt underlain by clay			Marionville silt loam
	grey clay			North Gower clay loam
				North Gower clay
	grey clay, low lime			Ste. Rosalie clay
	stratified brown and grey clay		Wendover clay	Bearbrook clay
Organic	Shallow organic over clay			Belmeade
	Deep organic			Muck

*Bottom Land soils are not included in the table. Differences among Bottom Land soils are presumably due to differences in parent materials.

occur as a result of seepage from adjacent areas of higher elevation. The Grenvill series belongs to the Brown Forest Great Soil Group.

Grenville loam (65,800 acres).

Grenville loam-bouldery phase (4,200 acres)

The following is a description of the Grenville loam as commonly found i uncultivated woodlots in Glengarry County:

A_0 — ½–0 inch of matted leaves and twigs

A_1 — 0–4 inches of very dark grey-brown (10YR 3/2)* loam; friable; medium crumb structure; medium i organic matter; few stones; no free carbonates; pH — 7.0

B_1 — 4–7 inches of pale brown (10YR 6/3) loam; friabl weak small nuciform structure; very indistinct horizon pH — 6.8

B_2 — 7–16 inches of dark grey-brown (10YR 4/2) loam friable; medium nuciform structure; few stones; n free carbonates; pH — 7.0

C_1 — 16–26 inches of dark grey-brown (10YR 4/2) loam stony; free carbonates; not compacted; pH — 7.6

C_2 — Grey (10YR 5/1) or grey-brown (10YR 5/2) loam till; stony; slightly compacted; calcareous; pH — 7.8

The parent material consists of unsorted till dominated by limestone with som sandstone fragments.

Stones occur throughout the profile and, in some areas, boulders occur on th surface in sufficient numbers to interfere with cultivation. Such areas are mappe as the bouldery phase of the Grenville loam.

In Lochiel township and in adjoining areas of Kenyon and Lancaster township there are areas mapped as Grenville loam in which the soil is lower in lime, ha some sandy or clayey overwash and a less well defined structural B horizon than th normal Grenville type.

When cultivated, the surface soil becomes a grey-brown loam of medium organi matter content. The natural vegetation includes sugar maple, beech, ash, and som elm.

Agriculture

Most of the Grenville loam is now cleared and used for agricultural purpose General farming and dairying are carried on to advantage as, corn, alfalfa, clove and small grains thrive on this soil type.

The supply of plant nutrients and lime is medium. The type of agriculture th stresses dairying provides a good supply of barnyard manure for return to the soi For the production of clovers and alfalfa, applications of potash and phosphor prove profitable; nitrogen should also be added for cereals and corn.

*Colour code number as taken from Munsell Colour Chart.

The fertility of the Grenville loam is fairly high but stoniness often hinders cultivation. If the boulders are not too numerous, it may be economical to remove them but, in many instances, the very stony land is used for pasture production.

The shallow phase of the Grenville loam occurring in Kenyon township is similar in fertility to the normal type. However, the bedrock occurring within two feet of the surface inhibits plant root development and reduces the moisture-holding capacity of the soil.

In a few areas where drumlins are common, erosion may be a problem especially if row crops are grown. Normal good management practices, however, usually suffice to control erosion on the Grenville soil type.

Eamer Series (151,700 acres)

Another group of soils developed on loamy till in Glengarry County is the Eamer series. The soils of this series are well drained and are developed on till that, being derived from Trenton limestone, is higher in lime than the till of the Grenville series. The topography is strongly undulating to rolling resulting in greater susceptibility to erosion than on the latter series.

Eamer loam (48,300 acres).

Eamer loam-bouldery phase (3,400 acres)

The profile characteristics of the Eamer series are those of the Brown Forest Great Soil Group. A description of a virgin profile of Eamer loam is presented below:

A_0 — ½–0 inch of matted leaf litter

A_1 — 0–5 inches of very dark grey (10YR 3/1) loam; friable; medium crumb structure; medium to high in organic matter; few stones; free carbonates may be present; pH — 7.0

B_1 — 5–10 inches of dark grey-brown (10YR 4/2) loam; friable; fine nuciform structure; few stones; free carbonates; pH — 7.0

B_2 — 10–18 inches of very dark grey-brown (10YR 3/2) loam; friable; medium nuciform structure; stones and boulders; free carbonates; pH — 7.2

C_1 — 18–23 inches of grey-brown (10YR 5/2) loam; slightly compacted; very weak fine nuciform structure; stony; calcareous; pH — 7.6

C_2 — Grey (10YR 5/1) loamy calcareous till; stony; somewhat compacted; pH — 8.0

The parent material is characteristically stony but in some areas where eskeroid deposits are present it becomes excessively stony. The parent material has some tendency to be compacted but no hardpan layer is developed in this soil.

A number of boulders, chiefly limestone, with some granite erratics are scattered about the surface, often in sufficient numbers to hinder normal cultivation.

The natural vegetation includes sugar maple, elm, and basswood.
The internal and external drainage is good.

When cultivated, the surface soil consists of a dark grey-brown loam of medium organic matter content.

Bouldery phase of Grenville loam or Eamer loam is non-cropland.

Agriculture

The Eamer loam is well adapted to general farm crops provided that the boulders are not too numerous. It is well supplied with lime and is fairly well supplied with other available plant nutrients. Cereals, hay, especially alfalfa and clovers, and pasture thrive on this soil. Addition of phosphatic fertilizers may give profitable increases in yield.

Because the topography is strongly undulating to rolling, there are many slopes on which erosion is a problem. On certain slopes, it may be advisable to break up the sod only about once in five years to renew the hay and pasture.

Eamer Loam, Bouldery Phase (3,400 acres)

Where stones and boulders occur on the surface of the ridges in numbers great enough to prohibit cultivation the soil has been mapped as the bouldery phase. Such areas commonly remain as woodland or are cleared and used as unimproved permanent pasture. Fair to good crops of forage grasses can be grown. This is probably the most satisfactory use for this bouldery land.

Matilda Series (4,600 acres)

The Matilda series is the imperfectly drained member of both the Grenville and the Eamer catenas. It was not possible to differentiate between the inadequately drained members of the two catenas. Matilda loam, the only type in the series, is an imperfectly drained Brown Forest Soil. The profile horizons are less distinct than in the well drained soils due chiefly to the imperfect drainage. The type occurs on undulating topography and on the lower slopes of drumlins.

The following is a description of a Matilda loam profile under cultivation:

A_C — 0–8 inches of greyish brown (10YR 5/2) loam; friable; medium crumb structure; few stones; medium organic matter content; no free carbonates; pH — 7.0

B_1 — 8–15 inches of brown (10YR 5/3) loam; slightly mottled; friable; fine crumb structure; pH — 6.8

B_2 — 15–22 inches of brown (10YR 5/3) loam; mottled; friable; weak nuciform structure; horizon is relatively indistinct and not always present; pH — 7.0

C — Grey (10YR 6/1) loamy calcareous till; stony; free carbonates; pH — 7.4

The parent material varies in pH from 7.2 to 8.0. It tends to become compacted and to hinder the natural internal drainage. The relatively smooth relief contributes to inadequate external drainage.

In some areas, considerable water washing has mixed some lacustrine material with the till materials. Such profiles are irregular in occurrence in areas that are too small to delineate. Matilda loam commonly occurs in seepage areas often too small to show on map within larger areas of Grenville loam.

The natural vegetation consists of elm with some maple on the better drained sites.

When cultivated, the surface soil is a grey-brown loam of medium organic matter content.

Agriculture

In general, the Matilda loam is used for semi-permanent pasture and hay production. It is fairly well supplied with nutrients and lime. Where local drainage conditions are improved, it compares favourably with the Grenville loam as an agricultural soil.

Artificial drainage is of value in this soil provided that the number of stones does not make tile drainage impractical. Buckwheat is well adapted to this type and, with favourable weather at seeding time, some spring grains can be grown even without improved drainage.

Lyons Series (1,300 acres)

The Lyons series, which is the poorly drained member of the Grenville and Eamer catenas, is represented in Glengarry County by the Lyons loam. It belongs to the Dark Grey Gleisolic great soil group as evidenced by the profile description below:

(With the exception of the A_e, the profile horizons are poorly defined.)

A_e — 0–10 inches of very dark brown (10YR 2/2) stony loam; high in organic matter; sometimes free carbonates are present; pH — 7.2

G — 10–24 inches of mottled grey (10YR 5/1) stony loam that grades into the parent material; pH — 7.5

C — Grey calcareous stony till; pH — 7.8

The entire profile is usually stony and hence artificial drainage is often impractical. The topography is depressional; hence there is often considerable seepage from adjoining uplands. As the amount of organic matter in the surface layer increases, the type grades into areas of muck.

Most of the soil of this type is supporting its natural vegetation of cedar, poplar, and elm, or has been cleared for permanent pasture.

Agriculture

The surface soil is fairly well supplied with plant nutrients but the poor drainage limits the type chiefly to the production of permanent pasture.

B. Soils Developed on Roughly Stratified Sand and Gravel (Glacial-fluvial Materials)

As the last great ice sheet melted, streams of meltwater made their way through great crevasses in the ice and finally flowed out in front of the glacier. Rock debris which was originally held by the ice was carried by the streams, and was deposited in their beds. When the ice finally melted from the area, the beds of the glacial streams remained as long narrow ridges of coarse sand and gravelly material. As a result of the above mode of deposition the relief is hilly, a condition that does not readily lend itself to general farming practices.

Kars Series (7,600 acres)

All of the glacial-fluvial material in Glengarry County is classified in the Kars series. This series is well drained. The other catenary members were not encountered in areas large enough to delineate on the map of Glengarry County.

The Kars series is represented by one soil type, the Kars gravelly sandy loam. The usual topographic form is one of long narrow ridges whose axes are roughly parallel to the direction of ice movement. The profile is well drained and, in some instances, excessively drained.

The profile characteristics identify the Kars with the Grey-Brown Podzolic great soil group.

A_0 — ½–0 inch layer of leaf litter

A_1 — 0–4 inches of dark grey-brown (10YR 4/2) sandy loam; very friable; very fine crumb to single grain structure; few stones; pH — 6.8

A_2 — 4–12 inches of yellow-brown (10YR 5/6) sandy loam very friable; single grain structure; few stones; pH — 6.6

B — 12–17 inches of dark brown (10YR 4/3) gravelly loam or sandy loam; friable; small nuciform structure; few stones; pH — 7.0

C — Roughly sorted gravel and sand; some free carbonates some boulders; pH — 7.0, contains some shale fragments.

Wherever the drainage is excessive, the horizon development is less distinct. The natural vegetation is maple with some beech and pine. Elm may occur in slight depressions.

There were many small cobble stones scattered about the surface, under natural conditions, but most of these have been removed from cultivated land and placed in stone piles. The cultivated surface soil is a light grey-brown sandy loam, low in organic matter. It is also low in essential plant nutrients; hence fertilization is necessary if the soil is used for general farm crops.

Agriculture

The stones that occur in the upper horizons of the Kars gravelly sandy loam may hinder the use of farm machinery. The removal of the stones from the surface increases the cost of bringing the soil into production and as the inherent productivity of the soil is low, stone removal may not be economical.

For specialized early crops such as potatoes and small fruits, the type is well suited provided that commercial fertilizer is used.

The rolling topography is conducive to erosion. Hence, during cultivation, the control of erosion is a problem. In addition, the coarse open subsoil tends to cause the soil to be droughty although the B horizon, which is relatively heavy in texture, aids in retaining a favourable moisture relationship.

During wet seasons, the Kars gravelly sandy loam becomes one of the better soils in the County for general farm crops because of its good drainage.

An area of Kars soil near Maxville is somewhat finer in texture than the normal Kars type. These loamy gravelly soils are less droughty, gently sloping and fairly high in fertility. The soils in this limited area rank among the better agricultural soils in the County.

C. Soils Developed from Sorted Outwash Materials

(1) Medium Sand.

The parent materials of this group of soils were deposited by water as it flowed out over the area in front of the glacier. As the rate of flow of the water decreased, particles of sand and fine gravel settled out to form the outwash plains of today. The topography is undulating with some gullying along stream courses. There is only a small acreage of water-laid sand in Glengarry County.

The medium sandy deposits of three feet or more in depth are classified in the Uplands catena which includes the well drained Uplands series, the imperfectly drained Rubicon series, and the poorly drained Granby series.

Uplands Series (100 acres)

The Uplands soils have developed on strongly undulating to rolling outwash sand or sandy loam under good to excessive drainage conditions. The open nature of the subsoil and the low lime content of the parent material favour the development of a Podzol type of profile as described below:

A_e — 0–3 inches of very dark grey (10YR 3/1) sandy loam; friable; single grain structure; medium to low in organic matter; pH — 6.0

Uplands sand is low in plant nutrients and tends to be droughty. Note the grey A_2 horizon characteristic of podzol soils.

A_2 — 3–5 inches of grey (10YR 5/1) sand; very friable; single grain structure; pH — 5.8

B — 5–17 inches of brown (10YR 5/3) sandy loam; friable; single grain to weak crumb structure; pH — 6.4

C_1 — 17–24 inches of yellow-brown (10YR 5/6) sand; friable; single grain structure; pH — 6.4

C_2 — Grey (10YR 5/1) sand and gravel; non-calcareous; pH — 6.6

There are no boulders within the profile, although a very occasional one may be found on the surface. If the soil is unprotected, "blow out" spots tend to develop. Coniferous forest is the common natural vegetation. The cultivated surface soil is very low in organic matter. Chemical tests indicate that the available plant nutrients also are in short supply.

Agriculture

A large proportion of the Uplands soil has been cleared and cultivated but has now been returned to pasture. The soil is not well suited to general farming because of low fertility and a tendency to be droughty. With adequate fertilization, grain and potatoes can be grown during seasons of favourable moisture supply.

Rubicon Series (3,000 acres)

The Rubicon soils contain the imperfectly drained members of the Uplands catena. They are found in undulating topography with numerous small knolls and depressions, hence the drainage conditions vary within short distances from good on the knolls to poor in the depressions.

The imperfectly drained soils which generally represent the larger proportion of areas of Rubicon soils are ground-water podzols, while on the better drained knolls the Upland Podzol is dominant and the poorly drained depressions are generally occupied by the Granby series.

A description of an average imperfectly drained Rubicon soil is given below:

A_0 — 0–5 inches of dark grey (10YR 4/1) sandy loam; very friable; single grain structure; pH — 6.5

A_2 — 5–10 inches of ashy grey (10YR 7/1) sand; very friable; single grain structure; pH — 6.0

B — 10–20 inches of dark brown (10YR 4/3) sandy loam; somewhat cemented; compact; pH — 6.2; grades into mottled brown sand. (Small pockets of ortstein may occur in this horizon).

C — Grey (10YR 5/1) sand sometimes stratified with silt or gravel; pH — 6.8

D — Underlain by clay at depth of 3 feet or more.

There are practically no stones throughout the profile nor on the surface. The native vegetation is predominantly elm, pine, and soft maple.

Under cultivation, the surface soil is yellow-brown on the knolls and dark grey in the depressions with streaks of ashy grey scattered throughout wherever the plow reaches the A_2 horizon. The soil in the depressions is often closely similar to the Granby as described later. The soil is moderately acid and low in plant nutrients.

Agriculture

The utility of this soil type is quite variable depending on the area of well drained knolls in proportion to the area of inadequately drained depressions. The open nature of the soil materials renders the retention of moisture poor where the sand is deep and the water table is low. The depressions usually require drainage but this

draining only accentuates the problem of moisture retention on the knolls. In areas where clay occurs relatively close to the surface (3-6 feet) drainage is frequently difficult to improve.

Some farmers carry on a general type of farming on the Rubicon sandy loam where the topography is relatively level and where the subsoil is either calcareous gravel or clay. The sandy loam type is valuable during wet seasons when finer textured soils fail to produce.

Granby Series (1,300 acres)

Depressional topography on sandy outwash material leads to the development of the poorly drained profile of the Granby series. The Granby sandy loam is the only member of the series in Glengarry County. It belongs to the Dark Grey Gleisolic Soil Group and has profile characteristics as described below:

A_0 — 1–0 inch of matted leaf litter.

A_1 — 0–5 inches of very dark brown (10YR 2/2) sand or sandy loam; very friable; single grain structure; pH — 6.8

G_1 — 5–11 inches of grey (10YR 5/1) sand; very friable; single grain structure; pH — 6.8

G_2 — 11–33 inches of grey (10YR 5/1) sand mottled with rusty brown; friable; single grain structure; pH — 6.9

C — Grey (10YR 6/1) sand stratified with some clay and silt; no free carbonates; pH — 7.0

At a depth of three feet or more, clay may be present but it has no obvious effect on the profile developed nor on the productivity of the soil. The native vegetation is elm, soft maple, cedar, and willow.

The natural surface soil is well supplied with organic matter that may be lost rapidly when the soil is drained and cultivated. The content of available plant nutrients is also low.

Agriculture

The native vegetation has been removed from much of the area but when the uselessness of the soil for farming was realized, the area was allowed to revert to the production of scrub willow. The soil is one of the poorest types in the County and is probably serving its best purpose in producing trees. Fortunately there is only a small acreage of Granby in Glengarry County.

If drainage and fertility are improved, good crops of hay and pasture can be produced. When drainage is improved, however, the soil tends to be droughty as a result of its coarse texture.

(2) Fine Sand.

There is a small acreage of water-laid fine sands in Glengarry County. These materials are lower in lime than the coarser sands. Soils developed from fine sands are classified in the St. Thomas series, well drained, and L'Achigan, imperfectly drained.

St. Thomas Series (100 acres)

The St. Thomas series has developed on well drained undulating fine sand under a vegetation dominated by pine. The St. Thomas fine sandy loam is the only type mapped. It belongs to the Podzol great soil group. A profile description is given below:

A_e — 0–3 inches of dark grey (10YR 4/1) fine sandy loam; friable; fine crumb structure; pH — 5.4–6.0

A_2 — 3–5 inches of grey (10YR 7/1) fine sand; single grain structure; pH — 5.4–6.0

B_2 — 5–11 inches of dark yellowish brown (10YR 5/6) friable fine sandy loam; fine nuciform structure; pH — 6.0

B_3 — 11–23 inches of yellow (10YR 7/6) fine sand; single grain structure; pH — 6.0

C — Very pale brown (10YR 7/3) fine sand; pH — 6.0

The soil materials are permeable; although layers of very fine sand and silt may be present in the C horizon; hence when denuded of vegetation, wind and water erosion may occur.

In cultivated areas the ashy grey A_2 horizon is usually mixed in the A_e horizon. The cultivated horizon is low in organic matter.

Agriculture

Much of the small acreage of St. Thomas fine sandy loam in Glengarry County has been cleared and is used for pasture production. Heavy fertilization and liming are required for satisfactory crops on this soil. Barnyard manure and green manure treatments help to maintain the organic matter content of the soil.

L'Achigan Series (3,100 acres)

The L'Achigan series is the imperfectly drained member of the St. Thomas catena. One type only, the L'Achigan fine sandy loam has been mapped. It is a Ground-water Podzol soil developed on level to gently sloping topography. An undisturbed profile is described below:

A_0 — 2–0 inches of partially decomposed vegetable matter

A_1 — 0–3 inches of very dark grey (10YR 3/1) fine sandy loam; friable; fine crumb structure; pH — 5.0

A_2 — 3–5 inches of grey (10YR 6/1) fine sand; single grain structure; pH — 4.8

B_2 — 5–10 inches of yellow-red (7.5YR 5/6) fine sandy loam; some mottling; friable; weak crumb structure; evidence of weak ortstein formation may be found in some areas; pH — 5.4

B_3 — 10–18 inches of yellowish brown (10YR 5/4) fine sand; very friable; single grain structure; pH — 5.6

C — Light brownish grey (10YR 6/2) fine sand; pH — 5.8

In the cultivated soil, remnants of the A_2 horizon are thin and may be entirely incorporated into the plow layer. The imperfect drainage and low fertility combine to make this soil of low agricultural value.

Agriculture

Artificial drainage improvement is seldom warranted on this soil because of its low natural fertility and low organic matter content. Some areas are used for hay and pasture production. L'Achigan fine sandy loam, however, is generally more useful in producing trees.

D. Soils Developed from Sorted Outwash Materials Underlain by Lacustrine Material within three feet.

In some areas, the lacustrine clay materials are covered by a thin veneer of coarse textured material. The depth of the sandy overburden varies from six inches to three feet and in some places, the clay appears at the surface. In general, the profile is developed in the coarser materials although clay may occur in the B horizons and lower.

Such sand-over-clay complexes have been classified in the Manotick Catena in Stormont County. In Glengarry County, however, only the poorly drained member, Allendale series has been mapped.

Allendale Series (8,200 acres)

The Allendale series is the poorly drained member of the Manotick catena. The topography is level to slightly undulating. The Allendale sandy loam is the only type recognized. The depth of sandy overburden varies somewhat resulting in variations in the drainage condition. The drainage is generally poor, both internal and external. The soil belongs to the Dark Grey Gleisolic Great Soil Group and exhibits profile characteristics described below:

A_1 — 0–6 inches of very dark brown (10YR 2/2) sandy loam; fine granular structure; very friable; stonefree; high in organic matter; pH — 6.4

G_1 — 6–9 inches of grey (10YR 6/1) sand or sandy loam; very friable; single grain structure; some mottling; pH — 6.4

G_2 — 9–25 inches of grey (10YR 6/1) sand; friable; single grain structure; intensely mottled with rusty reddish brown; pH — 6.5

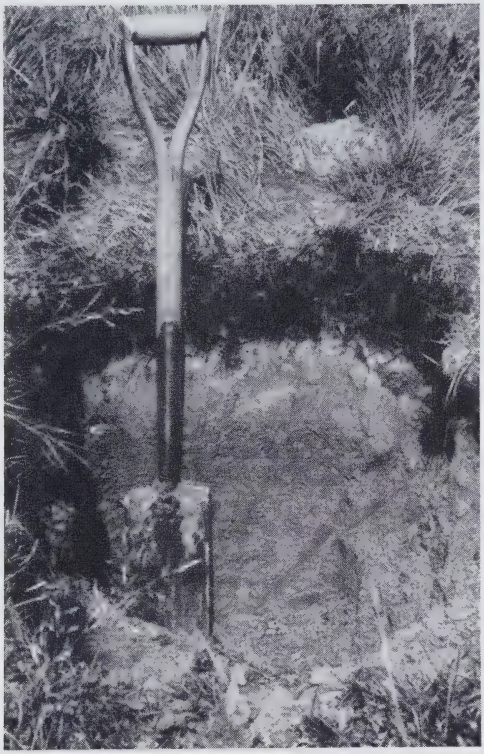
C — 25–36 inches of grey (10YR 6/1) sand; friable; single grain structure; non-calcareous; pH — 6.8

D — Grey clay or clay loam; plastic; massive structure; pH — 7.0

In common with the other members of the catena, the profile of the Allendale sandy loam is developed within the sandy materials. The clay material may have some influence on the moisture relationships.

The natural vegetation consisted of elm, ash, and poplar. Much of the type is cleared, and remains as permanent pasture.

The organic matter is not well incorporated with the mineral fraction. In some areas, it has accumulated to such an extent that the soil is similar to shallow muck. Improved drainage and careful cultivation result in a grey-brown surface soil of medium to low fertility.



A typical soil profile of Allendale sandy loam. Note heavier textured material immediately below the grey layer.

Agriculture

The common use for the soil type is the production of permanent pasture or trees. Some cereal grains, especially buckwheat, are grown to a limited extent.

Because of the proximity of the clay, the Allendale soil rates higher than the Granby series as far as crop production is concerned. The sand-clay complex makes artificial drainage improvement difficult and renders a uniform method of tillage and management impractical since the better drained knolls require a different treatment from that of the poorly drained depressions. Where drainage is improved, fertility needs and organic matter retention require careful attention.

Where small areas of Allendale sandy loam occur within areas of better drained soils, it is useful for pasture production, alsike clover being one of the important pasture species that thrives on this soil.

E. *Soils Developed from Deltaic Fine Sands and Silts*

In the southern part of Lancaster and Charlottenburg townships there is a large expanse of land where, except for occasional ridges, the till plain has been buried

beneath medium to fine water-laid deposits. These materials probably were deposited by still or very slowly moving water at the time of the recession of the Champlain Sea. The soils of this area are level, inadequately drained, and stonefree. Although numerous small streams drain from this area to the St. Lawrence River, many of the soils are poorly drained. The very level topography, the pervious nature of the upper strata of the soil, and the impermeable clay layer at relatively shallow depths contribute to a water-logged condition. Again a lack of suitable outlets complicates any artificial drainage programme. It is probable that a network of deep ditches, in spite of its many disadvantages, would solve this problem.

The soil materials of this area are only moderately well supplied with lime, ranging in reaction from about neutral to slightly acid. Many fragments of amber coloured mica are found in these materials. Many of the soils are characterized by moderately low fertility, although generally response is obtained from drainage as well as from fertilization. Good farming practices are required to maintain soil organic matter and structure. The return of barnyard manure and the incorporation of green manure crops are recommended.

Castor Series (7,300 acres)

No well drained series has been mapped on the deltaic sands and silts in Glengarry County. The Castor series is the imperfectly drained member of the Castor catena. Two types, Castor very fine sandy loam and Castor silt loam, have been recognized and mapped. In addition a small acreage of Castor very fine sandy loam-shallow phase has been mapped. The dominant natural vegetation is maple, elm, and some bur oak. The profile exhibits the characteristics of a weakly developed Ground-water Podzol. The following description is of a virgin profile located in Charlottenburg township.

A_0 — Shallow layer of raw organic materials

A_1 — 0–4 inches of very dark grey (10YR 3/1) fine sandy loam; friable; fine crumb; pH — 6.4

A_2 — 4–9 inches of light brownish grey (10YR 6/2) very friable; fine sandy loam; pH — 6.4

B — 9–19 inches of brown (10YR 5/4) mottled silt loam friable; fine to medium weak sub-angular blocky structure; pH — 6.6

C — Light brown-grey (10YR 6/2) fine sand and silt occasionally occurs in narrow layers; pH — 6.3

D — Clay often occurs at 30–36″

The surface reaction of the Castor series varies from about neutral to medium acid. The underlying material may be stratified and frequently grades into massive grey clay at about three feet. External and internal drainage are imperfect. Along the banks of the Raisin River, some moderately well drained areas have been included with the Castor series. Topography is smooth very gently sloping. In isolated instances, slight gully erosion has occurred where drainage water has cut through the sod cover. The profile is free of stones.

Agriculture

The Castor very fine sandy loam produces fair to good yields of most farm crops. Dairy farming is the main agricultural practice on this soil. The physical character of this soil makes cultivation relatively easy. Although impeded drainage does limit the range of crops that can be grown, cereal grains, corn, and hay and pasture are produced with good success. In many cases, liming will be required for the growth of legumes such as alfalfa and clovers. Good response can be expected, in most instances, from additions of commercial fertilizer. Organic matter maintenance may be a problem on cultivated soils. The return of barnyard manure to the soil and the plowing down of green manure crops are good practices on any soil. Care should be taken on this soil to prevent gully erosion in drainage channels where surface run-off occurs.

Castor Fine Loam, Shallow Phase (400 acres)

A shallow phase is mapped in association with the Castor fine sandy loam in areas where the underlying clay is within two feet of the surface. The proximity of the clay layer to the surface results in a moderately poorly drained condition on this soil. The utilization of the shallow phase is quite similar to that of the normal phase. However, the slightly poorer drainage puts a further limitation on the number of different crops that can be grown.

Castor Silt Loam (300 acres)

The Castor silt loam is the other member of the Castor series. It differs from the fine sandy loam type only in the slightly finer texture of the surface soil. The silt loam probably has a slightly higher natural fertility than the fine sandy loam. Most crops grown on the fine sandy loam can be grown with equal success on the Castor silt loam.

Bainsville Silt Loam (19,200 acres)

The Bainsville silt loam mapped for the first time in Glengarry County, is the poorly drained member of the Castor catena. It supports a natural vegetation of elm, pine, aspen, and grey birch and exhibits characteristics of the Dark Grey Gleisolic Great Soil Group. A description of a typical undisturbed profile follows.

A_0 — 1–0 inch of leaf litter and twigs

A_1 — 0–6 inches of very dark grey (10YR 3/1) friable; fine granular, silt loam; pH — 6.3

G_1 — 6–12 inches of greyish brown (10YR 5/2 slightly mottled; friable; laminated fine sand and silt; pH — 6.5

G_2 — 12–22 inches of greyish brown (10YR 5/2) mottled; brown (10YR 5/3) fine sand and silt; friable; laminated; pH — 6.6

C — Fine sand and silt; light brownish grey (10YR 6/2); layered; pH — 6.8

D — Clay often occurs at about three feet

The Bainsville silt loam occurs on smooth level topography. External drainage is poor; internal drainage is moderately poor to poor depending on the depth to the clay layer. The profile is stonefree and the soil has not suffered noticeably from erosion. In very poorly drained locations organic matter tends to accumulate in the surface and the profile approaches that of an organic soil.

Agriculture

Most of the Bainsville silt loam has been cleared and is used in the production of general farm crops, particularly cereal grains and hay and pasture for the support of dairy cattle. Fodder corn is also grown with fair success. Artificial drainage and liming are usually required for successful stands of alfalfa and most other legumes. Adequate fall for tile drains is difficult to obtain on this soil. Open ditches may be the best solution to the drainage problem.

This stonefree, silt loam is an easily tilled soil that generally responds well to artificial fertilization. Under improved drainage conditions, organic matter may tend to become depleted and good manurial practices are recommended to help prevent this serious loss.

F. Soils Developed from Deltaic Fine Sands and Silts Underlain by Lacustrine Clay within three feet

As the fine sands and silts of the Lancaster flats grade into the clay plains, transitional soils occur which have a shallow mantle of fine sand and silt overlying the clay. This overburden is very similar to the materials of the Castor catena and varies in thickness from a few inches to not more than two feet. The underlying material is neutral to slightly acid, massive, impervious grey clay.

Marionville Series (6,900 acres)

This soil has developed from shallow, deltaic fine sands and silts low in lime underlain by heavy grey clay. The natural vegetation appears to have been predominantly elm, red maple, and black ash. The natural drainage condition is poor and the profile exhibits the characteristics of the Dark Grey Gleisolic soils. The Marionville silt loam is the only member of the series in Glengarry County. A description of a profile follows:

A_1 — 0–5 inches of very dark grey (10YR 3/1) fine sandy loam or silt loam; friable; crumb structure; stonefree; medium in organic matter content; pH — 7.0

G_1 — 5–11 inches of grey (10YR 5/1) silt loam or very fine sandy loam; friable; granular structure; pH — 6.8

G_2 — 11–19 inches of grey (10YR 6/1) silt loam; weakly plastic; weak blocky structure; intensely mottled; pH — 7.0

G_3 — 19–36 inches of grey (10YR 6/1) clay loam; plastic; massive structure; mottled with rusty brown (10YR 5/3); pH — 7.0

C — Grey (10YR 6/1) clay or clay loam; very plastic; massive structure; non-calcareous; pH — 7.2

The C horizon is very similar to that of the North Gower series. It is difficult to determine the true parent material of this soil. The upper horizons are so coarse in texture (fine sandy loam) that it is unlikely that they were derived from the underlying C horizon material. The coarser material presumably is depositional overburden that is too shallow to allow a complete profile to develop within it. Hence, the profile extends through the overburden into the underlying lacustrine material. The

Bainsville silt loam is a stonefree soil of medium texture with fine clay at three feet below the surface.

lower part of the glei horizon is developed in the fine material. The C horizon then is the parent material of the lower horizons but not of the surface horizons.

The cultivated surface soil is a grey-brown fine sandy loam fairly well supplied with organic matter. In some areas, the G_1 horizon has become mixed with the A_1 resulting in a lighter colour in the surface layer.

Agriculture

Drainage is an important factor in the utilization of this soil type. With the installation of deep ditches and tile drains, however, much of the area can be used for general farming. The chief crops grown are hay and pasture with some acreage devoted to small grains.

G. Soils Developed on Lacustrine Materials

Lacustrine materials are of medium to fine texture having been deposited by still or very slowly moving water. As the glacier receded, much of this eastern portion of Ontario was inundated by glacial Lake Champlain and Gilbert Gulf. The particles

carried by the water flowing into the lake gradually settled to the lake bed. The farther retreat of the ice allowed the lakes to drain and so today only the beds of the lakes remain. The fine textured lacustrine plains represent the lake beds of late glacial times.

Over forty per cent of Glengarry County is occupied by fine textured soils developed from lacustrine deposits. The neutral silt loams and clays occur mainly in the south-western parts of the County. In Kenyon and Lochiel townships are found relatively large areas of brown and grey stratified clay. Smaller areas of slightly acid grey clays occur in Lancaster township and shallow lacustrine deposits underlain by fine sand and silt are found near Glen Gordon. The soils developed from these materials are imperfectly to poorly drained, medium in organic matter, and relatively fertile. Some of the better agricultural areas of the County are located on these soils.

1. Neutral Silt Loams

The neutral, medium textured lacustrine deposits of Glengarry County occur in association with heavier lacustrine materials and till or gravel ridges. It is probable that the medium texture results from the admixture of coarser materials from the ridges with fine clay sediments of the lacustrine plains. The soil materials are usually stratified and heavy clay often occurs at depths of about four feet. The Osgoode series is the only one occurring on these materials in Glengarry County.

Osgoode Series (16,200 acres)

Only poorly drained Dark Grey Gleisolic soils occur on the neutral silt loam of Glengarry County. These soils are mapped as the Osgoode series. Two members of the series, Osgoode silt loam and Osgoode silty clay loam have been mapped. The natural vegetation is predominantly elm, ash, and soft maple.

Osgoode silt loam (14,700 acres).

Osgoode silty clay loam (1,500 acres).

The following is a description of the silt loam profile under the original forest cover:

A_0 — ½–0 inch of matted leaf litter

A_1 — 0–6 inches of dark grey (10YR 4/1) silt loam; friable; fine granular structure; stonefree; no free carbonates; medium to high in organic matter; pH — 7.0

G_1 — 6–9 inches of light brownish grey (10YR 6/2) silt loam; friable; weak medium sub-angular blocky structure; some weak mottling; no free carbonates; stonefree; pH — 6.8

G_2 — 9–21 inches of grey-brown (10YR 5/2) silt loam; weakly plastic; massive structure; mottled; stonefree; no free carbonates; pH — 7.0

C_1 — Grey (10YR 5/1) silt loam; plastic; massive structure; mottled; free carbonates may be present; pH — 7.4

The parent material may have lenses or layers of sandy material intermixed with layers of clay but no stones are present. The topography is level to depressional.

Osgoode silt loam — a poorly drained soil developed in water-laid material.

The natural vegetation consisted of soft maple, elm, and ash. Under natural conditions, the surface soil is fairly high in organic matter which it retains under cultivation if reasonably well managed.

Agriculture

For the most part the Osgoode soils occur in small areas in Glengarry County and are used for pasture. The fertility level is medium but the restricted drainage is a limiting factor. The drainage problem can be overcome, however, by installation

of open ditches and tile drains. The type does not occur in large areas; hence any one farm is not likely to be all Osgoode silt loam or silty clay loam. Hay (red clover and alsike), pasture, and cereal grains are crops commonly grown on this soil. Osgoode silt loam or silty clay loam in association with a well drained soil type is an ideal combination for dairy farming.

2. Grey Clay, Calcareous

These materials occur in relatively small areas widely distributed throughout the County. The poorly drained North Gower series and the very poorly drained Belmeade series are the only ones mapped.

North Gower Series (21,000 acres)

The North Gower series includes fine textured soils of neutral to slightly alkaline reaction that are poorly drained.

The level to depressional topography inhibits drainage. The North Gower clay loam and North Gower clay are members of the series mapped in the County. They belong to the Dark Grey Gleisolic Soil Group. A description of a virgin profile is presented below:

North Gower clay loam (13,400 acres).

North Gower clay (7,600 acres).

A_0 — ½–0 inch of matted leaf litter

A_1 — 0–8 inches of very dark grey (10YR 3/1) clay loam; friable; medium crumb structure; stonefree; medium to high in organic matter; pH — 7.0

G_1 — 8–12 inches of grey (10YR 5/1) clay loam; plastic; fine blocky structure; mottled; stonefree; pH — 7.0

G_2 — 12–26 inches of grey (10YR 5/1) clay loam; plastic; fine blocky structure; intensely mottled; stonefree; pH — 7.2

C — Grey (10YR 6/1) silty clay loam; plastic; massive structure; stonefree; free carbonates present; pH — 7.4

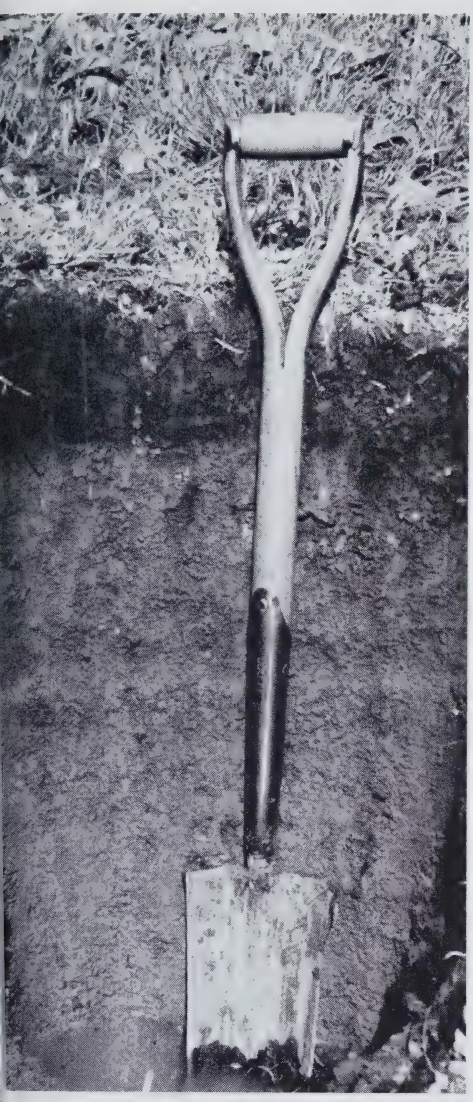
The parent material is usually stonefree although some grit may be present. The poor drainage results in horizons that are very indistinct and mottling often occurs immediately below the dark coloured A_1 horizon.

The natural vegetation consisted of elm, ash and soft maple. The organic matter content of the surface soil is medium to high and it is well incorporated with the mineral matter. The cultivated soil is very dark brown in colour with a medium to high fertility. The phosphorus and potash contents of the North Gower series are appreciably higher than those of comparable lacustrine deposits in Western Ontario.

Agriculture

A large percentage of this type in Glengarry County has been cleared and is being used for permanent pasture production with no improvement in drainage.

Cereal grains and some corn are grown, however, where ditches and tile drains have been installed.



North Gower clay loam — a highly productive soil when artificially drained.

General farming and dairying are common especially where well drained till reas occur in association with the lacustrine material. Cereal grains and alfalfa may e grown on the till soil while the poorly drained areas may be used for pasture and ay. The production and utilization of the North Gower clay loam varies greatly ith the season. The soil is naturally poorly drained and, therefore, during a wet ason its agricultural value is greatly decreased. Conversely, if the season is dry, the ne textured soil holds moisture better than the coarser soils and better crops result.

North Gower Clay (7,600 acres)

The North Gower clay is generally more poorly drained than the clay loam. The ay type often occurs in narrow valleys close to stream courses and is usually used

for hay or permanent pasture production. The lateness of this soil in the spring practically prohibits the growing of corn or cereal grains if artificial drainage is not provided.

3. Stratified Brown and Grey Clay

In central and northern Glengarry, there are large acreages of clay plains in which the parent soil materials are heavy, waxy, low lime clays, similar to the stratified brown and grey clays of Prescott and Russell Counties. These materials show indistinct bands of reddish brown clay alternating with bands of brownish grey clay. The soils developed on these materials are classified in the Wendover and Bearbrook series.

Wendover Series (1,800 acres)

The Wendover series is the imperfectly drained member of the Wendover catena. Developed on low lime stratified brown and grey clay under a maple and elm vegetation, the soil is classified as a weakly developed Grey-Brown Podzolic although it has many features of a Regosol. The Wendover clay is the only member of the series in Glengarry County. The following description is of a cultivated profile occuring in Lochiel township.

A_c — O–5 inches of very dark grey (10YR 3/1) moderately friable clay; medium granular structure; pH — 6.3

A_2-B_1 — 5–8 inches of indistinctly formed horizon; brown (10YR 5/3) clay; medium nuciform; pH — 6.3

B_2 — 8–16 inches of brown (10YR 5/3) clay; hard; large blocky structure; some mottles; pH — 6.6

C_1 — Heavy greyish brown clay.

C_2 — Heavy, waxy, blocky, clay; greyish brown (10YR 5/2) with faint bands of reddish brown clay (5YR 4/3) pH — 7.0

Occurring on gently sloping topography in association with stream courses, the Wendover clay is subject to serious gully erosion if not carefully managed. The internal drainage is imperfect but the surface run-off prevents serious water logging of the soil.

Profile development varies slightly with drainage. The better drained sites in close association with stream courses, tend to have slightly more distinct profile development than the areas farther back from the streams. The profile is stonefree. The layering of colours in the parent materials is indistinct and may not be found in some profiles.

Agriculture

Most of the Wendover clay has been cleared and is used for agricultural production. Fair to good crops of cereal grains are produced and grasses for hay and pasture yield well on this soil. Liming may be required in many cases for successful stands of alfalfa and clovers. Long rotations containing plenty of grasses are recommended to help prevent serious depletion of soil organic matter. Special care often is required to prevent gully erosion on susceptible areas.

Bearbrook Series (41,400 acres)

Bearbrook clay developed from stratified low lime brown and grey clays under poor drainage conditions. It is the poorly drained member of the Wendover catena. The profile, characteristic of the Dark Grey Gleisolic Great Soil Group, developed under a forest vegetation of elm and red maple. A typical cultivated profile located in Kenyon township is described below:

A_c — 0–5 inches of very dark brown (10YR 2/2) moderately friable; medium granular; clay; pH — 6.7

G_1 — 5–11 inches of mottled brown (7.5YR 5/4) clay; plastic; massive structure; pH — 6.8

G_2 — 11–23 inches of mottled brown (10YR 5/4) clay; plastic and massive; mottles more intense than in G_1 horizon; pH — 6.8

C — Heavy waxy light brownish grey (10YR 6/2) and reddish brown (5YR 4/3) clay; weakly banded; plastic; no free carbonates; pH — 6.9

The banding in the parent materials of the Bearbrook is indistinct and occasionally absent. The profile often assumes a brownish cast throughout, probably the result of the nature of the underlying clay. The topography is level and both internal and external drainage are poor. The profile is stonefree. North of Glen Robertson there is a small area of Bearbrook clay that has carbonates in the parent material and often in the surface.

Bearbrook soils are flat and poorly drained. Fine texture makes drainage difficult but necessary for good production of general farm crops.

griculture

Although poorly drained, this soil is often low in organic matter. Thus deterioion of structure on cultivation is not uncommon. Plowing down of green manure nd returning farmyard manure to the soil help to prevent this impairment of ructure.

The Bearbrook clay responds well to artificial drainage. The soil is very slow to warm up in the spring and often seeding of spring grains is prevented. When drained this soil produces fair to good yields of most farm crops in normal years. Good stands of grasses and cereal grains can be expected. Corn does only moderately well. Liming is often necessary for the successful growth of legumes.

4. Grey Clay non-calcareous.

In Lancaster township, near to the Ontario-Quebec border, there is an area of clay soil developed from massive grey marine clay that is neutral to slightly acid in reaction. The parent materials are stonefree and do not effervesce with dilute hydrochloric acid. Soils developed on this type of materials have been mapped in Carleton and Russell Counties and classified in the Rideau catena. Only the poorly drained member of the catena has been recognized and mapped in Glengarry County.

Ste. Rosalie Series (1,700 acres)

The Ste. Rosalie clay is the poorly drained member of the Rideau catena developed on the low lime grey clays. The natural forest vegetation has been elm, red maple, and some pine. The profile exhibits Dark Grey Gleisolic characteristics. The following description is of a typical profile in Lancaster township.

A_c — 0–6 inches of very dark grey (10YR 3/1) clay; moderately friable; medium granular structure; pH — 6.5

G_1 — 6–10 inches of mottled greyish brown (10YR 5/2) clay; plastic; massive; pH — 6.7

G_2 — 10–20 inches of greyish brown (10YR 4/2) conspicuously mottled with many rust coloured mottles; massive; pH — 6.8

C — Fine clay, tends to break out in large blocks; colour (7.5YR 5/2) brown; pH — 6.8

The Ste. Rosalie clay occurs on level topography. Surface run-off is low and internal drainage is very slow, resulting in a poorly drained condition. The profile is stonefree. Erosion is not a hazard to land use on this soil.

H. Soils Developed from Organic Materials

1. Shallow Underlain by Clay.

In areas bordering muck land, soils may develop with a thin layer of organic material (6–15 inches thick) underlain by clay. These soils are classified in the Belmeade series.

Belmeade Series (2,400 acres)

Soils developed on materials similar to those of the North Gower series under conditions of very poor drainage are included in the Belmeade series. The topography is depressional.

The Belmeade muck is the only member of the series and it exhibits the profile characteristics of a Shallow Organic Soil. The profile that obtains under virgin conditions is described below:

A_0 — 0–15 inches of black (10YR 2/1) layer of organic matter in varying stages of decomposition; pH — 6.8

G_1 — 15–20 inches of grey (10YR 5/1) clay; plastic; massive structure; stonefree; pH — 6.8

G_2 — 20–36 inches of grey (10YR 6/1) clay; plastic; massive structure; mottled with rusty brown; stonefree; pH — 6.8

C — Grey (10YR 6/1) clay or silty clay; plastic; massive structure; stonefree; occasionally free carbonates are present; pH — 7.0

The surface horizon under cultivation is quite variable. In some areas, the native forest has been removed and the organic surface layer partially burned in an effort to improve the soil for general agriculture. The effort has been successful in some areas and the organic matter remaining has been incorporated with the mineral soil. The surface layer then becomes a very dark grey clay or clay loam about 6–8 inches deep very closely resembling that of the North Gower series.

In many areas, however, the burning has not improved the soil for crops because the organic matter was completely burned and the grey subsoil low in organic matter has become the surface soil. This layer is difficult to handle because of poor aeration and low supply of available nutrients.

Agriculture

The acreage of Belmeade muck in Glengarry County is relatively small. Much of the type is still in forest and natural pasture and probably is serving its best use in that state. Areas which have been cleared and prepared successfully for farming are used in the same manner as the areas of North Gower clay loam. Improved drainage allows the production of hay, pasture, buckwheat, and cereals in relatively dry seasons.

2. Deep Organic Deposits

Muck (22,600 acres)

There is an appreciable acreage of organic soils widely distributed in Glengarry County. All areas that have eighteen inches or more of organic material overlying the mineral soil have been classed as muck. It belongs to the Organic Great Soil Group.

Description

18 inches or more of organic layer consisting of semi-decomposed vegetative material, usually neutral to alkaline on the surface. Underlying material may be till, sand or clay.

Agriculture

Very little of the muck areas is used for general crops. The natural vegetation of elm, tamarack and cedar may be used for fuel but most of the area still remains in

the wooded condition. For agricultural production, muck soils require clearing and drainage and it is doubtful if the returns would warrant the expenditure for development under present economy.

I. Soils Developed From Recent Alluvium

Bottom Land (19,400 acres)

The complex of soil conditions adjoining stream courses is called Bottom Land. Such land is subject to flooding and hence a great variety of alluvial material has been deposited. The reaction, texture, and profile characteristics are extremely variable.

Agriculture

The chief use of the soil is for the production of permanent pasture.

PART IV

EARLY SETTLEMENT AND AGRICULTURAL DEVELOPMENT

Glengarry County was first entered by white people about the year 1784 by United Empire Loyalists from New York State who emigrated following the American Revolution. Several parties of settlers from Scotland followed in succeeding years. By 1794 all four townships had been entered, Kenyon being the last to be settled. The St. Lawrence River to the south supplied trade connections with Montreal and up until 1882 most of the County's produce was shipped by water or on the Grand Trunk Railway from Lancaster. In 1882 the Ottawa to Montreal rail line was built and Alexandria (formerly Priests' Mills) became the centre of trade for the County. It was incorporated as a village in 1883 and as a town in 1902.

The first churches in the County were built at Lancaster and St. Raphaels about the year 1790. One of the first stone churches was erected at Kirkhill in the middle 1860's and still stands.

The first newspaper published in Glengarry was the "Glengarry Times" at Lancaster in 1881. However, it was short lived. The "Glengarry News" established in 1897, and the "Times" (1915) are still publishing in Alexandria.

Timber, lumber and some pulpwood furnished a livelihood for the early settlers. As the land was cleared it came into use for agricultural purposes. The first agriculture was of a subsistence nature, each farm producing according to the needs of the people. As the land was developed, dairy farming was practised and now Glengarry has long been noted for its milk and cheese production. As early as 1881 there were seventeen cheese factories and three creameries in the County. At present, the number of small cheese factories is gradually declining due to competition from large scale milk-processing plants.

Although the amount of maple sugar and syrup produced in Glengarry County is declining, these products have, in the past, provided an important source of supplemental income. In the early 1890's production reached a maximum of about 600,000 gallons of syrup per year. The corresponding figure for 1940 is about 20,000 gallons.

According to the Ontario Agricultural Commission Report of 1881, Glengarry County farmers used no artificial fertilizers at that time and only small areas of land had been drained.

PRESENT AGRICULTURE AND LAND USE

Glengarry County lies in the milk producing area of Eastern Ontario. The predominant present agricultural practice is summer dairying. The land is used in the production of such crops as are required of such a system of farming. Other agricultural endeavours of lesser importance in the County are swine and poultry raising, grass seed and flax production. Other products as potatoes and maple syrup account for a smaller portion of the farm income.

A large proportion of the milk was processed within the County at the many small cheese factories. Some fluid milk now finds its way to the Montreal market. Considerable income has come from the export of dairy cattle to the United States but this market has failed in recent years. Hog raising affords a convenient and economical means of using the whey which is a by-product of the cheese making

industry. In recent years the fluid milk market has expanded a great deal and local cheese factories have been abandoned.

The following tables show the present land use in Glengarry County.

TABLE 6

CONDITION OF LAND IN GLENGARRY COUNTY (1951 CENSUS)

	Acres	%
Total land area	305,920	100.0
Area of occupied farm land	264,383	86.6
Improved land	161,722	45.6
Unimproved land	102,661	33.6

The occupied farm land consists of 2,287 farms of an average acreage of about 100 acres.

The present use of occupied farm land is shown in Tables 7 and 8 for improved and unimproved land respectively.

TABLE 7

IMPROVED LAND (1951 CENSUS)

	Acres	%
Area of Improved land	161,722	100.0
Field crops	122,867	76.0
Pasture	32,814	20.4
Fallow	711	0.3
Other	5,330	3.3

Field crops and improved pasture occupy only 96 per cent of the improved land. Fifty-nine acres are used for fruits and vegetables according to the 1951 Census.

TABLE 8

UNIMPROVED LAND (1951 CENSUS)

	Acres	%
Area of unimproved land	102,661	100.0
Woodland	41,529	40.5
Marsh and Waste	61,132	59.5

Approximately one-half of the unimproved land is used as natural pasture. Forty and one-half per cent of the unimproved land (12.8% of the total area of the County) remains as woodland.

The Statistics Branch of the Ontario Department of Agriculture reports the following acreages of field crops in Glengarry County in 1955.

TABLE 9

ACREAGE OF FIELD CROPS IN GLENGARRY COUNTY (1955)

	Acres
Hay	75,800
Oats	39,300
Barley	1,950
Wheat	500
Mixed grain	5,200
Buckwheat	2,800
Rye	200
Corn	3,300
Potatoes	300
Total Field Crops	129,580

The acreage of field crops varies somewhat from year to year. The 1941 Census of Canada reports 129,594 acres of field crop in Glengarry County. Small differences can be noted in the amounts of each crop. Significant is the change in the flax acreage during the period 1941-1949. While the 1941 Census reports 1,037 acres of flax, the 1949 Statistics list only 30 acres and none in 1955. This marked change probably is due to alterations in the market and the labour supply.

The statistics quoted above indicate the cropping system of the County which emphasizes hay and pasture for dairy cattle along with cereal grains, chiefly oats.

About 38.2 per cent of the total improved land is in hay each year. Of the total hay, only about 12.4 per cent is alfalfa, which reflects the large area of poorly drained soil which is not suitable to alfalfa production. Large acreage of improved and natural pasture are used for summer grazing.

Crop Adaptability Ratings and Land Use Management

Of the various factors that affect soil productivity, climate is one than cannot be altered. Fortunately, the climate of Glengarry County is suitable for the production of a wide range of crops. In addition to such general farm crops as oats, barley, alfalfa, timothy, hay and pastures, specialized crops such as apples are produced in some areas. The successful production of any crop depends on the suitability of the soil to produce that crop. The simplest method of soil conservation and good land use management is the selection of crops that produce most efficiently and economically on the soil types available.

The potentialities and limitations of the soil types for crop production have been discussed in Part III. The comparative adaptability of individual soil types for selected crops grown in the area is a useful beginning for better land use management. The soil type is specific in character having more or less constant chemical and physical properties. Such features as drainage, topography, erodability, and stoniness as well as organic matter content, texture, structure, reserve supply of nutrients and water are evaluated in determining the comparative adaptability of soil for a certain type of crop production.

The limitations of such crop adaptability rating must be realized in the beginning.

It is a theoretical rating based on a consideration of the natural fertility and productivity of the soil under the prevailing system of management in relation to the requirements of the crop concerned. The absolute rating of crop adaptability under specific management must be obtained from average yields over a significant number of years. The introduction of new varieties of crops, new management practices, market variations or other unforeseen factors may necessitate adjustments or changes in some of the ratings.

On the basis of the best information available from soil workers, agronomists, and farmers, as well as on observations made during the survey, the soils of the County have been arranged into six adaptability groups and rated for nine crops commonly grown in the area. Because of the marked influence that the amount of rainfall exerts on the adaptability of the soils of the area separate ratings are presented for a normal and a wet season.

Group I — Good Cropland

Soil Type	Acreage	% Total Acreage of County
Eamer loam	48,300	15.8
Grenville loam	65,800	21.5
Osgoode silt loam	14,700	4.8
Osgoode silty clay loam	1,500	0.5
North Gower clay loam	13,400	4.4
Total	143,700	

A large portion of Glengarry County is classed as good cropland. The soils included in this group provide the most economical production of the common crops under the prevailing systems of management. The till soils of the group (Eamer and Grenville) have a general disadvantage in that they are susceptible to erosion when brought under cultivation. The Eamer loam with its strongly undulating to gently rolling topography has the most serious erosion hazard. Normal good management, however, with adequate crop rotation on the steeper slopes suffices to stabilize the soil. Stones on the Eamer and Grenville loams may be so numerous that they must be removed to allow efficient cultivation. Although these soils may not produce highest yields, they are capable of producing a wide variety of crops.

The remainder of the soils of the group are stonefree, fine textured, and tend to be inadequately drained. The simple installation of open ditches and tile drains however, allows good crop production in most seasons

This group of soils has a naturally high fertility and organic matter content that can be easily maintained. Parcels of land that include both well drained and inadequately drained members of this group provide good returns for the operator who specializes in dairying.

TABLE 10

*CROP ADAPTABILITY RATINGS FOR GOOD CROPLAND

Soil Type	Oats		Barley		Alfalfa		Red Clover		Timothy		Potatoes		Buckwheat		Fodder Corn		Permanent Pasture	
	N.S	W.S	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.
Eamer loam	G–F	G–F	G–F	G–F	G	G–F	G	G–F	G–F	G	F	F–P	G	G	G	G–F	G–F	G–F
Grenville loam	G–F	G–F	G–F	G–F	G–F	G–F	G	G–F	G–F	G	G–F	F	G	G	G	G–F	G–F	G–F
Osgoode silt loam	G	G–F	G	G–F	F	F–P	G–F	F	G	G	F	F–P	G	G–F	G–F	F	G	G
Osgoode silty clay loam	G	G–F	G	G–F	F	F–P	G–F	F	G	G	F	F–P	G	G–F	G–F	F	G	G
North Gower clay loam	G	F	G	F	F–P	P	G–F	F	G	G	F–P	P	G–F	F	F	F–P	G	G

N.S — Normal Season

W.S. — Wet Season

*Crop adaptability ratings for each soil type as follows:

G—Good; G–F—Good to Fair; F—Fair; F–P—Fair to Poor; P—Poor.

Group II — Good to Fair Cropland

Soil Type	Acreage	% Total Acreage of County	Chief Limitations
Wendover clay	1,800	0.6	impermeable subsoil
Castor very fine sandy loam	6,600	2.1	drainage and fertility
Castor silt loam	300	0.1	drainage
Matilda loam	5,800	1.9	drainage
Bainsville silt loam	19,200	6.3	drainage
Marionville silt loam	6,900	2.2	drainage
North Gower clay	7,600	2.5	drainage and poor soil structure
Ste. Rosalie clay	1,700	0.5	drainage and poor soil structure
Bearbrook clay	41,400	13.5	drainage, low lime
Grenville loam-shallow phase	4,200	1.4	droughtiness, shallow rooting zone
Total	95,400		

The Manotick sandy loam, in particular, requires the addition of some commercial fertilizer and care in the conservation of organic matter for good crop production. Improved drainage is required on many of the soils in this group. In this respect, the Matilda loam has the disadvantage of being stony, a condition that makes drainage expensive and in some instances impractical.

The above limitations combine to increase the cost of crop production on the soils of the group thereby decreasing the net returns for the farmer.

TABLE 11

*CROP ADAPTABILITY RATINGS FOR GOOD TO FAIR CROPLAND

Soil Type	Oats		Barley		Alfalfa		Red Clover		Timothy		Potatoes		Buckwheat		Fodder Corn		Permanent Pasture	
	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.
Wendover clay	G–F	F	G–F	F	G–F	F	G–F	F	G	G	G–F	F	G–F	G–F	G–F	F	G	G
Castor very fine sandy loam	G–F	F	G–F	F	F	F	G–F	F	G	G	G–F	F	G–F	G–F	G–F	F	G	G
Castor silt loam	G–F	F	F	F	F	F	F–G	F	G	G	F–P	P	G–F	F	G–F	F	G	G
Matilda loam	G–F	F	G–F	F	F	F	F–G	F	F–G	F–G	F	F–P	F	F	F	F–P	G	G–F
Bainsville silt loam	G–F	F	F	F	F	F	F	F	G–F	F	F–P	P	F	F	F	F	G–F	F
Marionville fine sandy loam	G–F	F	F	F	F	F–P	F	F–P	G	G–F	F–P	P	G–F	F	F	F–P	G	G
North Gower clay	G–F	F	F	F	F	F–P	F	F–P	F	F	P	P	G–F	F	F	F	G	G–F
Grenville loam-shallow phase	F	F	F	F	F–P	F–P	F–P	F–P	F	F	F	G–F	F	F	F	F	F	G–F
Ste. Rosalie clay	G–F	F	F	F	F	F–P	F	F–P	G	G–F	F–P	P	G–F	F	F	F–P	G	G
Bearbrook clay	G–F	F	F	F	F	F–P	F	F–P	G	G–F	F–P	P	G–F	F	F	F–P	G	G

N.S.—Normal Season

W.S.—Wet Season

*Crop adaptability ratings for each soil type as follows:

G—Good; G–F—Good to Fair; F—Fair; F–P—Fair to Poor; P—Poor

Group III — Fair Cropland

Soil Type	Acreage	% Total Acreage of County	Chief Limitations
Kars gravelly sandy loam . .	7,600	2.5	fertility and erosion susceptibility
Uplands sandy loam	200	0.1	fertility, low moisture
St. Thomas fine sandy loam	100	0.1	fertility, low moisture
Rubicon sandy loam	3,000	1.0	fertility and drainage
L'Achigan fine sandy loam	3,100	1.0	fertility and drainage
Total	15,000		

The lack of fertility and adequate drainage is a rather serious hindrance to crop production. Hence, the soils of this group must be considered as only fair cropland.

All of the soils are coarse textured, are low in fertility and lose organic matter rapidly under cultivation. The Kars soil type is developed on rolling topography and hence has an erosion problem on the slopes.

Special attention must be paid to organic matter maintenance on the soils of this group. Fortunately, the dairy type of farming in the area provides material for the above purpose. The Rubicon, Uplands, St. Thomas and L'Achigan soils often respond to applications of lime.

The soils are well suited to potato production and are useful for cereal grain production during wet seasons when the finer textured soils have too much moisture. On the average, the yields of general farm crops from this group of soils are only fair under the management practices in common use in the area.

TABLE 12

*CROP ADAPTABILITY RATINGS FOR FAIR CROPLAND

Soil Type	Oats		Barley		Alfalfa		Red Clover		Timothy		Potatoes		Buckwheat		Fodder Corn		Permanent Pasture	
	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.
Kars gravelly sandy loam	F	F	F	F	F–G	F–G	F–P	F–P	F	F	G–F	G–F	F–P	F–P	G–F	F–G	F–P	F–P
Uplands sandy loam	F–P	F	F–P	F	F–P	F	F–P	F	F–P	F	F	G	F–P	F	F–P	F–G	F–P	F
St. Thomas fine sandy loam	F–P	F	F–P	F	F–P	F–P	F–P	F	F–P	F	G–F	G	F–P	F	F	F	F–P	F
Rubicon sandy loam	F–P	F–P	F–P	F–P	P	P	F–P	P	F	F	F	F–P	F	F	F–P	P	F–P	F–P
L'Achigan fine sandy loam	F–P	F–P	F–P	F–P	P	P	F–P	P	F	F	F	F–P	F	F	F–P	P	F–P	F–P

N.S.—Normal Season

W.S.—Wet Season

*Crop adaptability ratings for each soil type as follows:

G—Good; G–F—Good to Fair; F–Fair; F–P—Fair to Poor; P—Poor.

Group IV — Fair to Poor Cropland

Soil Type	Acreage	% Total Acreage of County	Chief Limitations
Belmeade muck	2,400	0.8	drainage
Granby sandy loam	1,300	0.4	drainage and fertility
Lyons loam	1,800	0.6	drainage and fertility
Allendale sandy loam	1,500	0.5	drainage and fertility
Total	7,000		

The soils of Group IV are moderately to poorly suited for the production of general farm crops. As a group, the lack of drainage is an important factor limiting the productivity of the soils. In the case of the lighter textured soils, when drainage has been improved, fertility becomes a limiting factor in production. The Lyons soils have an added limitation — excessive stoniness that hinders attempts at artificial drainage as well as cultivation. The Belmeade muck soil has a deep organic layer that is often partially burned off and incorporated with the mineral soil for crop production. The above limitations and the cost of overcoming these limitations greatly increase the cost of production. Under the present system of management and at present agricultural prices, such soils must be classed as fair to poor cropland.

TABLE 13

*CROP ADAPTIBILITY RATINGS FOR FAIR TO POOR CROPLAND

Soil Type	Oats		Barley		Alfalfa		Red Clover		Timothy		Potatoes		Buckwheat		Fodder Corn		Permanent Pasture	
	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.
Belmeade muck	F	P	F	P	P	P	P	P	F	F–P	P	P	F–P	P	F–P	P	F	F
Granby sandy loam	F–P	P	P	P	P	P	P	P	F	F–P	P	P	F	F–P	F	F–P	F	F–P
Lyons loam	F–P	P	F–P	P	P	P	P	P	F–P	F–P	P	P	F–P	P	P	P	F–G	F
Allendale sandy loam	F–P	P	P	P	P	P	P	P	F	F	P	P	F	F–P	P	P	F	F

N.S.—Normal Season

W.S.—Wet Season

*Crop adaptability ratings for each soil type as follows:
G—Good; G–F—Good to Fair; F–Fair; F–P—Fair to Poor; P—Poor.

Group V — Poor Cropland

Soil Type	Acreage	% Total Acreage of County	Chief Limitations
Eamer loam (bouldery phase)	3,400	1.1	stoniness
Total	3,400		

There is only a small acreage of poor cropland in Glengarry County. Also, each unit area of such land is generally small and in association with better cropland. Wherever the soils of this group occur, however, they create a problem in land use.

The bouldery Eamer loam cannot be cultivated unless the stones are removed. This is an expensive procedure and so usually the soil is left for pasture production.

Group VI — Submarginal Cropland

Soil Type	Acreage	% Total Acreage of County	Chief Limitations
Bottom land	19,400	6.3	drainage
Muck	22,600	7.4	drainage
Total	42,000		

*CROP ADAPTABILITY RATINGS FOR POOR CROPLAND

Soil Type	Oats		Barley		Alfalfa		Red Clover		Timothy		Potatoes		Buckwheat		Fodder Corn		Permanent Pasture	
	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.
Eamer loam (bouldery phase)	P	P	P	P	F–P	F–P	F–P	F–P	F–P	F–P	P	P	P	P	P	P	F	F

N.S.—Normal Season

W.S.—Wet Season

*Crop adaptability ratings for each soil type as follows:

G—Good; G–F—Good to Fair; F–Fair; F–P—Fair to Poor; P—Poor.

TABLE 15

*CROP ADAPTABILITY RATINGS FOR SUBMARGINAL CROPLAND

Soil Type	Oats		Barley		Alfalfa		Red Clover		Timothy		Potatoes		Buckwheat		Fodder Corn		Permanent Pasture	
	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.
Bottom Land	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
Muck	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P

N.S.—Normal Season

W.S.—Wet Season

*Crop adaptability ratings for each soil type as follows:

G—Good; G–F—Good to Fair; F–Fair; F–P—Fair to Poor; P—Poor.

A relatively large proportion of Glengarry County is classed as submarginal cropland. The large number of meandering streams have a large acreage of bottom land associated with them. This land is subject to flooding during periods of high rainfall. Hence, permanent pasture production is the best use that can be made of such land. The muck areas which make up 13.3 per cent of the area are not used for general farming. The cost of drainage improvement and provision of irrigation facilities for market gardening is costly so that commercial development of the muck soils will be confined to small and most favourably situated areas. The unimproved muck soils are of little agricultural value.

TABLE 16

SUMMARY OF CROP ADAPTABILITY GROUPS WITH ACREAGES AND CHIEF LIMITATIONS

	Acreage	% Total Acreage of County	Chief Limitations
Group I	143,700	47.1	
Group II	95,400	31.1	drainage
Group III	15,000	4.7	fertility
Group IV	7,000	2.3	drainage, fertility
Group V	3,400	1.1	stoniness
Group VI	42,000	13.7	drainage
	302,100	100.0	

MECHANICAL ANALYSES, pH, CATION EXCHANGE CAPACITY AND ORGANIC MATTER CONTENT OF SURFACE SAMPLES OF GLENGARRY COUNTY SOILS

Soil Type	Sample No.	Location			Sand % 1-.05 mm.	Silt % .05-.002 mm.	Clay % <.002 mm.	pH (glass electrode)	Cation Exchange Capacity m.e./100gms.	Exchangeable Cations			Organic Matter %
		Township	Lot	Con.						Calcium m.e./100gms.	Magnesium m.e./100gms.	Potassium m.e./100gms.	
Allendale sandy loam	55	Charlottenburg	14	II Front	51.2	44.8	4.0	5.8	19.1	12.8	1.6	0.10	6.5
	56	Charlottenburg	7	I Front	37.6	60.0	2.4	5.7	16.2	10.1	2.1	0.05	5.6
Bainsville silt loam	3	Lochiel	19	V M	17.0	67.9	15.1	6.2	29.0	21.0	7.1	0.19	6.7
	11	Charlottenburg	17	II	17.2	67.9	14.9	6.8	23.0	24.9	3.4	0.10	5.5
	13	Charlottenburg	15	VI	19.7	67.3	13.0	5.8	12.0	7.7	1.6	0.23	3.7
	40	Lancaster	18	III M	29.7	61.2	9.1	6.1	11.6	7.4	2.4	0.05	2.9
	42	Lancaster	20	I S	24.6	68.0	7.4	6.5	22.2	19.7	3.7	0.09	6.0
	43	Lancaster	36	III S	21.3	68.5	10.1	6.3	11.7	7.7	2.1	0.04	3.2
	67	Charlottenburg	26	I N	17.4	74.1	8.5	7.1	16.6	16.5	2.7	0.08	4.7
	4	Lochiel	20	VI M	30.0	50.5	19.5	6.7	26.6	21.5	5.7	0.20	6.2
Eamer loam	15	Charlottenburg	17	X S	39.0	38.4	22.6	7.2	26.1	39.0	2.1	0.19	6.6
	16	Charlottenburg	25	X S	46.2	37.0	16.8	7.2	20.2	26.8	1.6	0.15	4.9
	36	Kenyon	1	I M	36.2	40.4	23.2	7.6	27.5	34.6	1.4	0.20	5.5
	46	Charlottenburg	30	XI N	60.5	31.4	8.1	6.3	16.1	12.7	1.9	0.39	3.5
	68	Charlottenburg	36	I N	41.9	41.5	16.6	7.2	30.2	29.8	3.8	0.17	6.9
	70	Charlottenburg	40	VI S	48.2	41.7	10.1	6.8	23.3	23.8	0.9	0.11	5.6
Grenville loam	18	Kenyon	41	II N	53.0	37.3	9.7	6.5	26.0	24.6	2.1	0.12	6.8
	27	Lochiel	9	IV M	32.2	46.4	21.4	7.2	25.0	18.3	5.8	0.20	6.1
	29	Lochiel	31	IV M	48.4	34.8	16.8	6.2	26.6	23.6	1.9	0.12	6.9
	31	Kenyon	26	IX M	43.4	44.2	12.4	7.0	21.5	24.7	1.6	0.14	5.8
	35	Kenyon	12	III N	45.3	40.2	14.5	7.2	22.7	24.0	1.4	0.17	4.7
	63	Lancaster	17	VI N	52.7	35.1	12.2	7.0	21.1	19.5	2.5	0.14	4.8
Kars gravelly sandy loam	19	Kenyon	39	VI S	55.6	31.2	13.2	7.1	17.7	20.0	2.1	0.11	4.2
	20	Kenyon	35	VI S	57.0	30.6	12.4	6.8	30.9	31.1	2.6	0.12	8.0
	25	Lochiel	8	IX M	39.4	51.1	9.5	6.5	49.6	47.1	3.5	0.51	13.1
	34	Lochiel	38	VI M	61.7	31.5	6.8	6.8	23.8	24.5	1.3	0.18	4.4

APPENDIX TABLE 1 (Cont'd.)

Soil Type	Sample No.	Location			Sand % 1-.05 mm.	Silt % .05-.002 mm.	Clay % <.002 mm.	pH (glass electrode)	Cation Exchange Capacity m.e./100gms.	Exchangeable Cations			Organic Matter %
		Township	Lot	Con.						Calcium m.e./100gms.	Magnesium m.e./100gms.	Potassium m.e./100gms.	
Castor fine sandy loam	7	Charlottenburg	10	III	30.8	61.5	7.7	5.8	14.1	9.3	1.3	0.13	5.3
	8	Charlottenburg	17	IV	24.5	63.2	12.3	5.6	15.4	6.8	1.8	0.16	5.1
	41	Lancaster	20	I M	27.6	62.4	10.0	5.5	16.3	5.6	1.1	0.20	4.1
	52	Charlottenburg	26	V	25.0	69.0	6.0	5.7	13.2	4.7	0.9	0.09	6.4
	64	Lancaster	30	I S	26.9	66.4	6.7	6.6	16.7	13.0	2.4	0.07	4.6
	69	Charlottenburg	32	IV N	17.9	68.4	13.7	6.7	18.2	15.0	2.3	0.11	3.4
Bearbrook clay	1	Lochiel	32	II N	13.4	39.2	47.4	5.9	37.3	26.7	7.3	0.31	5.6
	2	Lochiel	11	II N	15.1	39.7	45.2	7.2	38.9	43.2	3.7	0.40	7.5
	21	Kenyon	41	IX S	15.7	43.3	41.0	7.2	42.3	45.8	4.5	0.41	6.7
	28	Lochiel	1	III M	19.4	36.4	44.4	5.6	25.3	10.9	5.6	0.51	4.2
	30	Kenyon	1	IX M	19.9	31.8	48.3	6.6	38.0	32.7	4.8	0.37	6.4
	71				31.7	28.7	39.6	6.0	36.2	21.2	6.8	0.51	5.3
Marionville silt loam	9	Charlottenburg	35	IV	17.6	62.1	20.3	6.0	20.6	17.1	3.1	0.15	4.8
	10	Charlottenburg	40	IV	20.3	66.9	12.8	6.0	13.5	10.2	1.8	0.18	4.0
	24	Lancaster	9	I S	32.1	54.1	13.8	5.2	17.8	7.6	2.7	0.21	6.3
	37	Lancaster	24	VII S	45.0	35.3	19.7	6.3	30.1	26.3	3.5	0.24	5.3
Matilda loam	17	Charlottenburg	36	X M	49.7	40.3	10.0	6.6	28.2	27.1	2.4	0.12	7.7
	49	Kenyon	37	IV N	61.0	28.7	10.3	6.3	21.6	18.5	1.8	0.75	5.3
North Gower clay	38	Lancaster	16	V M	20.1	55.1	24.8	6.2	26.9	22.4	4.1	0.21	4.5
	51	Charlottenburg	24	VII	16.0	61.4	22.6	7.0	36.3	41.5	1.9	0.25	6.6
	54	Charlottenburg	45	I N	45.4	39.0	15.8	5.8	23.9	16.1	3.3	0.28	4.2
	62	Lancaster	16	VIII M	18.2	57.4	24.4	6.6	35.0	29.7	3.5	0.24	6.1
St. Thomas fine sandy loam	12	Charlottenburg	14	IV	32.1	63.5	4.4	5.7	12.7	7.7	1.5	0.96	4.8
	59	Charlottenburg	11	III M	23.5	69.3	7.2	6.1	15.3	10.6	0.9	0.07	4.0
Wendover clay	5	Lochiel	17	VI N	15.6	34.0	50.4	5.4	29.6	13.1	6.6	0.40	6.1
	6	Lochiel	8	VI N	18.8	32.2	49.0	6.0	41.2	29.8	9.5	0.57	9.1

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IL SURVEY OF VICTORIA COUNTY

REPORT No. 25 OF THE ONTARIO SOIL SURVEY

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Prepared jointly by The Experimental Farm Service, Canada Department of Agriculture and the Ontario Agricultural College

ANADA DEPARTMENT OF AGRICULTURE, OTTAWA
NTARIO DEPARTMENT OF AGRICULTURE, TORONTO

THE SOIL SURVEY of VICTORIA COUNTY

by

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Experimental Farms Service

and

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GUELPH, ONTARIO
1957

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Land Use Ratings for the Soils of Victoria County

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Good to Fair Cropland 5
Fair Cropland 5
Fair to Poor Cropland 6
Poor Cropland 6
Non-Agricultural Land 6

Appendix 6

Map ..... Soil Map of Victoria County in back pocket of rep

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PREFACE

Following is a list of counties and districts of Ontario which have been surveyed and maps published.

Norfolk	Map only
Elgin	Map only
Kent	Map only
Haldimand	Map only
Welland	Map only
Middlesex	Map only
Carleton	Map only
Parts of North Western Ontario	Map and Report
Durham	Map and Report
Prince Edward	Map and Report
Essex	Map and Report
Grenville	Map and Report
Huron	Map and Report
Dundas	Map and Report
Perth	Map and Report
Grey	Map and Report
Bruce	Map and Report
Peel	Map and Report
York	Map and Report
Stormont	Map and Report
New Liskeard — Englehart area	Map and Report
Lambton	Map and Report
Ontario	Map and Report
Glengarry	Map and Report

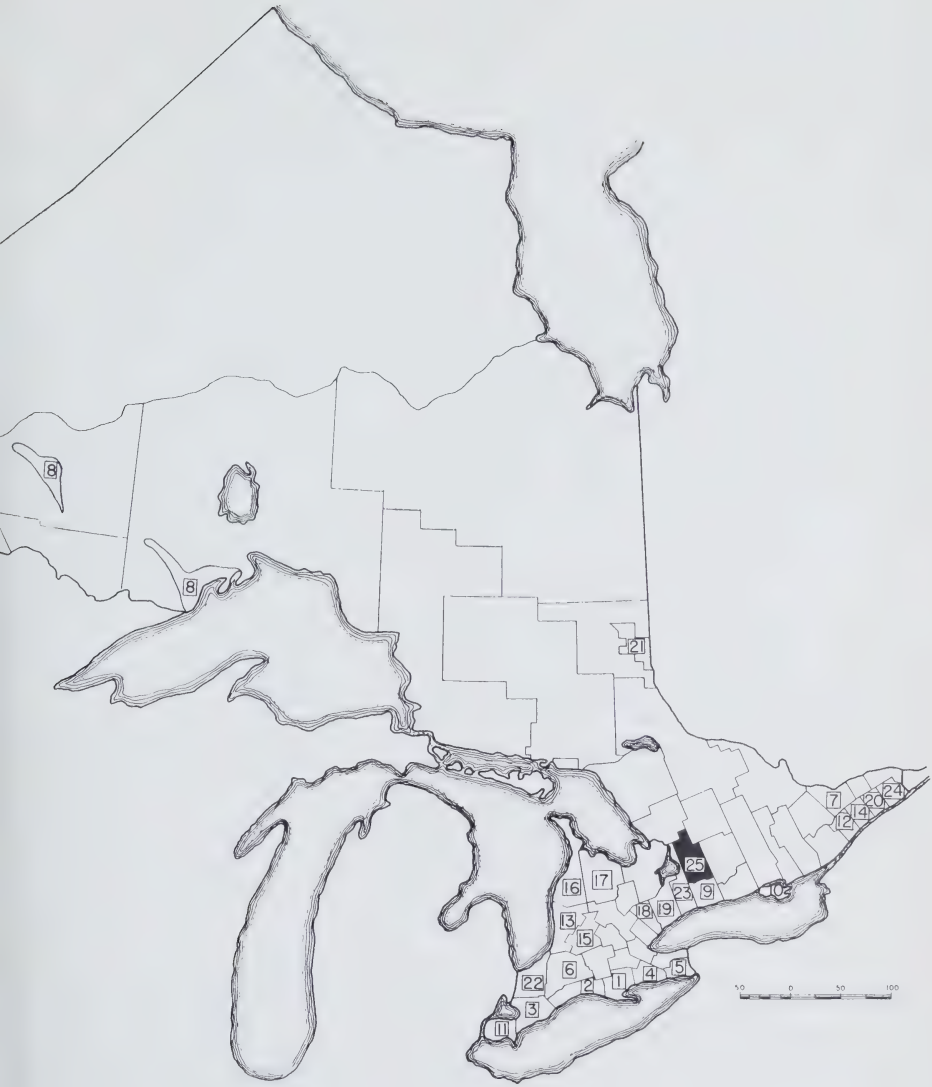


FIGURE 1. Outline map of Ontario showing location of Victoria County and other areas for which published maps have been published.

INTRODUCTION

The soil survey of a County is essentially an inventory of the soils in tha area. In the survey the characteristics of the soil units are observed and th boundaries of these units are delineated on a map which has a scale of one inc to a mile. In the report the characteristics of each soil type are discussed as we as the various problems that may be encountered in cultivation. The soil typ have been rated for their adaptability to produce the crops generally grown in th County and are arranged in six classes as follows: good crop land, good to fa crop land, fair crop land, fair to poor crop land, poor crop land, and no agricultural land.

In using the map it should be kept in mind that this is a reconnaissanc survey and therefore is on a scale too small to show such detailed variations i soil types as may occur on individual farms.

The soil survey of the County was initiated in the spring of 1950 and th field work was completed in the following year.

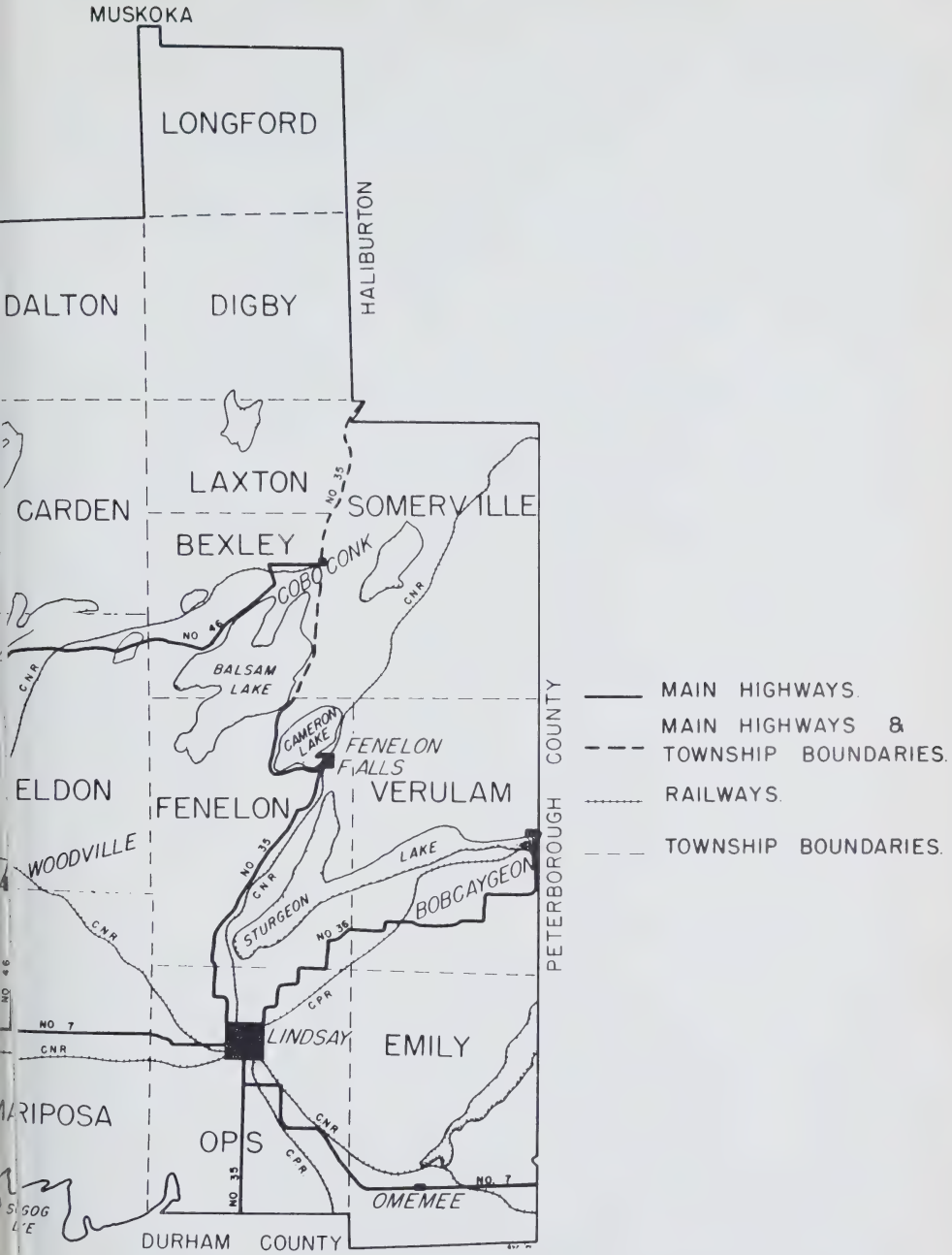


FIGURE 2. Townships, Principal towns, Highways, and railroads in Victoria County.

GENERAL DESCRIPTION OF THE COUNTY

Location and Area

The County of Victoria is located in south-central Ontario. It is bordere by Peterborough County on the east, Ontario on the west, Haliburton on th north and Durham on the south.

The total land area of the County is 862,720 acres. Of this acreage 477,56 acres or about 55% of the total area is occupied farm land*.

County Seat and Principal Towns

The County seat is Lindsay with a population of 9,603*. It is the large town in the County and has a fine business section and a number of industrie Other towns in the County are: Bobcaygeon, (population 1,207) * a scenic tow at the junction of Sturgeon and Pigeon lakes, is a tourist resort and lumberin town. Fenelon Falls (population 1,304)* is situated at the junction betwee Cameron and Sturgeon Lakes. It is a resort area and in addition has several sma industries.

Population

The total population of Victoria County is 27,127*. About 34% of th number or 9,306 are farm dwellers while 66% (17,821) are classified as urba

The population of the County reached its peak in 1881† when there we 33,655 persons. Since that time there has been a steadily decreasing populatio until the 1951 census showed an increase over the ten year period 1941 to 195

The northern townships consisting of Carden, Dalton, Digby, Bexley, Laxto and Longford are sparsely populated.

Transportation and Markets

Lindsay is approximately 64 miles from Toronto and may be reached Highway No. 7 which crosses the southern half of the County. This provides convenient outlet to the Toronto market for agricultural produce. Highwa 35 and 36 from Fenelon Falls and Bobcaygeon respectively, link up with No. Highway at Lindsay. In addition there are improved roads radiating through t County.

Canadian National and Canadian Pacific railway lines branch out fr Lindsay giving the County fairly good rail coverage.

The numerous summer resorts around Sturgeon, Pigeon, Balsam and Scug Lakes provide a good local market for milk, cream, butter, eggs, vegetabl small fruits and poultry.

The Trent Canal system crosses the County making use of Balsam, Camer and Sturgeon lakes. This waterway was at one time an important means transportation but its present value lies in its attraction for vacationers.

* Ninth census for Canada 1951.

†Report of the Ontario Agricultural Commission 1881.

Present Agriculture

Victoria County is predominantly a mixed farming area. Farm income is obtained from the sale of cream and beef cattle. The large tracts of shallow soils over limestone bedrock provide suitable range for beef cattle and many farmers have bought land on these shallow soils for summer pasture.

The large acreage of unoccupied land (shown in Table 1) is located in the northern part of the County. Most of this is within the Precambrian shield, although a large area is found on the very thinly covered limestone plains in Harden and Laxton townships. The acreage of unimproved occupied land, which includes much of the range land mentioned above, is given in Table 1.

Fifty-five per cent of the total land area is classified as occupied land of which about one-half is improved land.

The acreage and average yield of crops grown in the County are shown in Table 2.

TABLE 1
PRESENT LAND USE

	Acres		
	1941	1951*	Per Cent of Total (1941)
Total land area	862,720	—	—
Occupied land	488,739	477,508	56
Improved cleared land	241,177	237,367	27
Under crops	169,507	139,019	—
Unimproved occupied land	247,562	240,141	28
Including:			
Natural pasture	153,744	176,481	17
Wooded	68,469	63,660	7
No. of farms	2,860	2,314	—

*Canada Census, 1941, 1951.

TABLE 2
ACREAGE OF PRINCIPAL CROPS

	1941	1951*	Average Yield: 1952†	
	Acres		Victoria	Provincial
Hay (including alfalfa and clover)	63,819	62,826	1.93 tons	1.81 tons
Alfalfa (alone)	8,578	1,487	—	—
Sweet clover	1,206	—	—	—
Mixed grain	25,486	25,157	39.0 bu.	42.0 bu.
Oats	42,750	30,089	37.8 bu.	39.0 bu.
Barley	9,405	2,340	33.0 bu.	33.0 bu.
Buckwheat	3,204	938	25.0 bu.	22.0 bu.
Fall rye	1,013	239	18.9 bu.	20.0 bu.
Fall wheat	9,667	11,920	31.0 bu.	32.0 bu.
Spring wheat	556	85	—	—
Flax	137	36	—	—
Silage corn	3,507	3,452	9.6 tons	11.2 tons
Peas (dry)	1,710	378	—	—
Turnips	1,633	309	—	—

A considerable acreage of alfalfa and clover is used for seed production as will be noted in Table 3.

*Canada Census, 1941, 1951.
†Agricultural Statistics for Ontario, 1952.

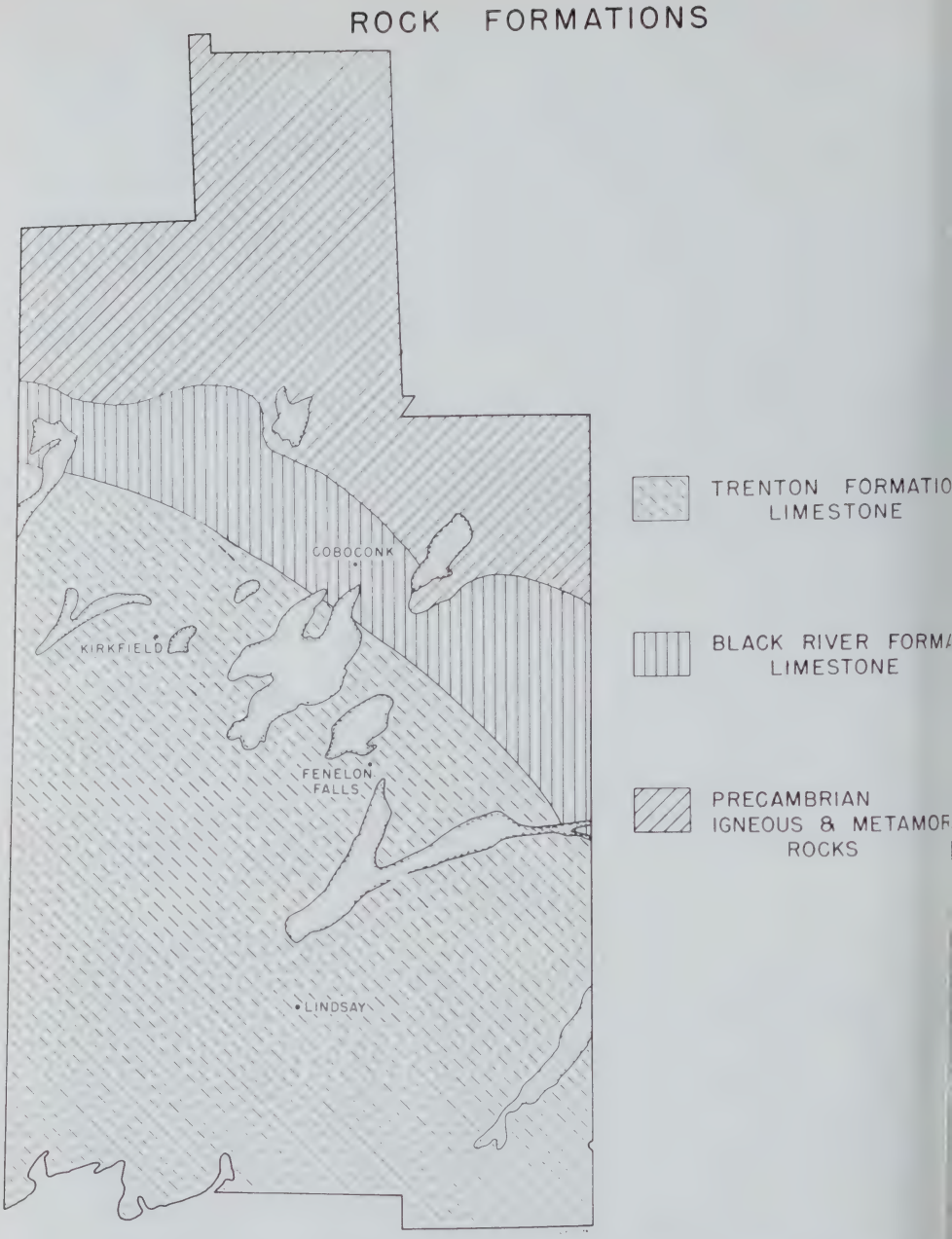


FIGURE 3. Outline map showing the bedrock geology of Victoria County.

ANALYSIS OF VICTORIA COUNTY LIMESTONE*

	SiO_2	Fe_2O_3	$CaCO_3$	$Ca_3(PO_4)_2$	$MgCO_3$	Otl
Trenton	2.92	0.34	92.91	0.52	0.88	2.
Black River	1.38	0.31	96.55	0.02	0.76	0.

*Limestones of Canada, Part IV. Department of Mines and Resources.

Mariposa was once the centre of a prosperous clover seed industry.

TABLE 3

SMALL SEED PRODUCTION IN VICTORIA COUNTY – 1951

Variety	Acreage	Value
Alfalfa	807	$ 4,770
Alsike	1,560	17,867
Red clover	3,379	25,427

Alsike seed production in Victoria County has dropped from a quarter of a million dollar industry to the present level in a little over ten years. This reduction has been due to the failure of the alsike to produce seed. Many causes have been advanced for seed failure in this area and perhaps the drop in wild bee population and increasing insect injury to the clover blossom are responsible for a large part of the loss. Research on this problem is at present underway at the Ontario Agricultural College.

GEOLOGY

The entire County has been glaciated and the rock is largely concealed beneath a mantle of glacial drift. In the northern part of the County the drift is very thin and the topography is essentially a reflection of the bedrock geology. In the southern part of the County the rock is deeply buried by glacial till and lacustrine deposits.

Precambrian rocks consisting of igneous and metamorphic rocks occupy the northern part of the County as shown in Figure 3. A relatively narrow band of Black River limestone adjoins the Precambrian area. This is a fine grained dense limestone. Extensive flats occur on this formation with very little soil cover. Underlying the greater part of the County are the Trenton limestones. These rocks are fine to medium grained and some formations are thinly bedded and weather to loose rubble.

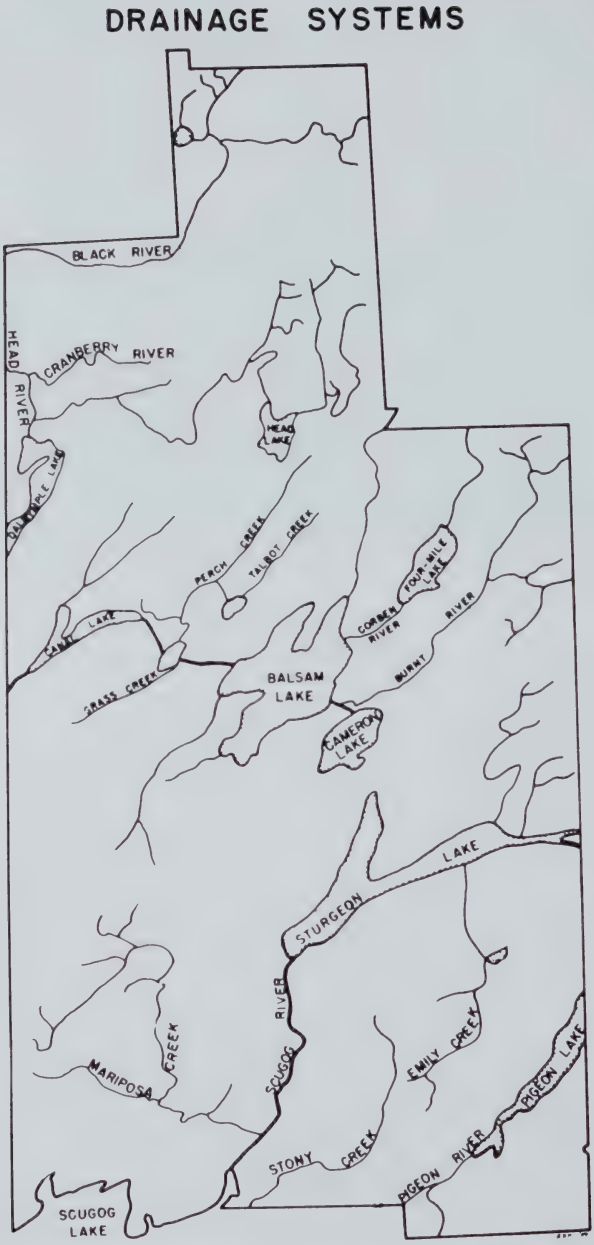


FIGURE 4. Outline map showing the natural drainage systems in Victoria County.

DRAINAGE

The external drainage system in Victoria County is shown in Figure 4. It will e seen that the entire County is covered by a wide network of rivers and lakes. he height of land between Cameron and Sturgeon lakes divides the County into vo portions so that the streams on the north flow south-west and west and those n the south flow north-east and east. Much of the water in the northern rivers iginates in the Precambrian shield. These rivers are swift flowing and fluctuate pidly in volume with the amount of rainfall. Many of the streams in the uthern part of the County are spring fed originating in the drumlinized areas that region and in the sandy areas of adjacent counties. The slope of the land such that few swampy areas can occur.

LANDSCAPE FEATURES

The topography over the County is quite varied. In the southeastern part Victoria the soil materials are deep and roughly formed into steeply sloping ge drumlins. The steepness of the slope limits the use of this land for agri-lture. In the western part of the County there is another highland area but the pes are generally not as steep and a larger proportion of the land can be tivated. Between these two highland areas is the former lake bed of glacial e Schomberg. The undulating topography in the lake bed is broken by merous small but steeply sloping drumlins.

In the northern part of the County there is a large level limestone plain which upies most of Carden, Laxton, Bexley, and Somerville Townships.

The northern townships of Longford, Dalton and Digby are within the cambrian shield and the relief is associated with the rough bedrock pattern.

CLIMATE

In "Climate of Southern Ontario", Putnam and Chapman* include most of oria County in the Simcoe and Kawartha lakes region. This region has colder ters and later springs than those regions lying closer to the Great Lakes.

The mean annual temperature is 42 to 44°. Winter temperatures range from o 19°, spring 39 to 41°, summer 65 to 67°, fall 46 to 47°.

The frost-free period ranges from 120 to 140 days on the average, while the ving season is 188 to 195 days.

The precipitation of this region ranges from 26.5 to 33.9 inches. The growing on receiving slightly more than half, while the months of June, July and ust receive 7.0 to 9.0 inches.

*Putnam, D. F., and Chapman, L. J. The Climate of Southern Ontario, Sci. Agr. Vol. XVIII, No. , April 1938.

Tables 4 and 5 give the mean monthly and annual temperature and precipit tion data for Lindsay in Victoria County, and other selected points.

TABLE No. 4

MEAN MONTHLY AND ANNUAL TEMPERATURE FOR LINDSAY AND OTHE SELECTED POINTS

	Period of Record	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Y
Lindsay	57	16	16	26	41	54	64	68	66	59	46	34	21	4
Guelph	44	20	18	29	42	54	63	68	66	59	48	36	24	4
Huntsville	30	14	12	24	39	52	61	66	64	57	45	32	19	4
Ottawa	65	12	13	24	41	55	65	70	66	58	46	32	17	4

TABLE No. 5

MEAN MONTHLY AND ANNUAL PRECIPITATION FOR LINDSAY AND OTH SELECTED POINTS

	Period of Record	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Y
Lindsay	57	2.94	2.39	2.42	2.24	2.85	2.91	3.07	2.81	3.06	2.68	2.86	2.60	3
Guelph	44	2.39	1.74	1.79	2.38	2.72	2.84	3.07	2.86	2.50	2.39	2.44	2.14	2
Huntsville	30	3.09	2.45	2.78	2.09	2.85	3.69	2.96	2.70	3.84	3.44	3.24	3.28	3
Ottawa	65	2.93	2.17	2.77	2.70	2.47	3.52	3.39	2.56	3.23	2.93	2.98	2.58	3

Sanderson (1) has applied the Thornthwaite method of climatic classifi tion to Canadian conditions and indicates that it provides a reliable index soil moisture deficiency.

The potential evapotranspiration values obtained from the Thornthwa method are defined as the amount of water that would be transferred from soil to the atmosphere by evaporation and transpiration if it were consta available in optimum quantity.

It is necessary to know the storage capacity of a soil, the evapotranspirat and precipitation in the area. From this data it is possible to obtain the moist deficiency of any given soil series.

As a guide to the moisture situation in Victoria County the available moistu holding capacity of the Otonabee series has been determined (3) and Tabl shows the soil moisture relationships for the year.

TABLE No. 6

MOISTURE DEFICIENCY IN LINDSAY AREA ON THE OTONABEE SOILS

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Evapotranspiration	0	0	0	1.1	3.1	4.5	5.2	4.5	3.0	1.4	0	0
Precipitation	2.9	2.4	2.5	2.2	2.8	2.9	3.1	2.8	3.1	2.7	2.8	2.6
(2) Storage in soil (2 foot depth)	4.	4.	4.	4.	3.7	2.1	0	0	.1	1.4	4.	4.
Deficiency	0	0	0	0	0	0	0	1.7	0	0	0	0

(1) Marie Sanderson, The climates of Canada according to the new Thornthwaite classifica Sci. Agr. Vol. 28, No. 11, Nov. 1948.

2) The available moisture holding capacity was obtained by multiplying the moisture equivalent percentage by the factor .5710 as described by Snyder and Weeks in their paper "Soil Productivity Ratings in Economic Analysis," Soil Sci. Vol. 82, No. 2, August 1956.

3) See Appendix, Table 1.

The climatic data used in Table 6 are monthly means for 57 years and the eficiency of 1.7 inches for August on the Otonabee loam is low when compared ith many other counties. It means that except for exceptionally dry years hay d grain crops are not seriously hindered by lack of moisture. Pastures and second t hay will have reduced growth in August.

Clay soils, which have a larger water-holding capacity than loam soils should ve a very small deficiency in moisture in August but the coarse textured sandy ils which may not hold more than 2.0 to 2.5 inches of water will have serious isture deficiencies in July and August.

THE CLASSIFICATION AND DESCRIPTION OF VICTORIA COUNTY SOILS

During the process of soil development various layers or horizons develop wi in the soil. These horizons vary in number, kind and arrangement in a given re on according to the type of soil material and drainage. Collectively they make up he soil profile and it is on the latter that the classification of soils is based.

In Victoria County four major kinds of soil development have taken place. On this basis the various soils that occur can be placed in one of four groups na ely, Grey-Brown Podzolic, Brown Forest, Podzol and Dark Grey Gleisolic Gr t Soil Groups. The Grey-Brown Podzolic and Brown Forest soils occur in th outhern part of the County, the Podzol soils are found in the non-calcareous sa s of the northern area and the Dark Grey Gleisolic soils comprise the poorly dr ed soils that occur throughout the County.

A Grey-Brown Podzolic Soil Profile

The following profile description is representative of the Bondhead se which is classified as a Grey-Brown Podzolic Soil.

A_1 — 0–3″ (10 YR 3/2) very dark greyish brown; sa loam; crumb structure; soft; friable consiste pH 7.0.

A_{21} — 3–15″ yellowish brown (10 YR 5/4) sandy lo granular structure; friable consistency; pH 6.6.

A_{22} — 15–17″ grey-brown (10 YR 5/2) sandy loam; p structure; friable consistency; pH 6.6.

B_2 — 17–20″ brown (7.5 YR 4/2) loam; subang blocky structure; friable; pH 7.2.

C — grey-brown (10 YR 5/2) sandy loam till.

Soils of Brown Forest Great Soil Group have Shallow Profiles and a Brownish Colour in the Subsoil.

A profile representative of the Brown Forest Great Soil Group is given below. This is a profile description of the Otonabee series.

A_1 — 0–4″ very dark grey (7.5 YR 3/1) loam; granular and crumb structure; friable; pH 7.2.

B_{21} — 4–8″ brown (7.5 YR 4/4) loam; subangular blocky structure; friable; pH 6.8.

B_{22} — 9–12″ very dark grey-brown (10 YR 3/2) loam; subangular blocky structure; friable; pH 7.0.

B_3 — 12–16″ dark grey-brown (10 YR 4/2) loam; subangular blocky structure; friable; pH 7.6.

C — pale brown (10 YR 6/3) loam; calcareous; pH 8.3.

A Podzol Soil Profile

The profile characteristics of the Podzol soils are illustrated by the follo ing profile description of the Wendigo series.

A_{00}— 1–0″ raw humus layer of pine needles, twigs, etc.

A_2 — 0–2″ white (10 YR 8/1) sand; single grain structu loose consistency; pH 5.0.

B_2 — 2–6″ very dark grey-brown (10 YR 3/2) sandy loa crumb and granular structure; friable; pH 5.8.

C_1 — 11–17″ yellowish brown (10 YR 5/6) sand; sin grain structure; pH 6.8.

C_2 — pale brown (10 YR 6/3) sand; pH 7.0.

Note dark grey surface soil and grey mottled subsoil of Dark Grey Gleisolic Soil

In poorly drained locations the water table is close to the surface for a large rt of the year. Soils with profiles developed under these conditions are classified Dark Grey Gleisolic soils. The following description of a profile of the Lyons ies is representative of this group of soils.

A_e — 0–8″ black (10 YR 2/1) loam; crumb structure; pH 7.2.

G_1 — 8–13″ grey (10 YR 5/1) loam; mottled; angular blocky structure; friable consistency; pH 7.2.

G_2 — 13–18″ grey (10 YR 5/1) loam; angular blocky structure; friable; mottled; pH 7.4.

C — grey calcareous loam till; pH 8.2.

In very poorly drained areas organic matter decomposition is very slow and ganic deposits accumulate. In such areas muck and peat beds have developed.

Soil Series, Soil Types and Phases

There are three categories which are commonly employed in the classification of soils in the field.

They are: (1) series, (2) type and (3) phase.

The soil series includes all the soils in an area developed from similar parent materials and that show the same genetic features in the profile but having some variations in texture especially in the surface horizons. The series is given a geographical name usually taken from the area where the series was first recognized and established. Example — Otonabee.

The soil type is the mapping unit that consists of the series name plus the textural class name determined from the texture of the surface horizon. Example — Otonabee loam.

A phase is a separation within a soil type based on some physical variation from the normal as in topography, stoniness, depth to bedrock, etc., which are important from a land use standpoint. Example — Otonabee loam — shallow phase.

SUMMARY OF THE CLASSIFICATION OF THE SOILS OF VICTORIA COUNTY

A. Soils Developed from Calcareous Loam — Sandy Loam Till

I. Moderately Stony Till

		Acreage
(a) Good Drainage		
1. Otonabee loam	B.F.	102,90
2. Otonabee loam—shallow phase	B.F.	25,50
3. Otonabee loam—steep phase	B.F.	8,00
4. Otonabee sandy loam	B.F.	13,00
		149,40
(b) Imperfect Drainage		
1. Emily loam	B.F.	19,00
2. Emily loam—shallow phase	B.F.	2,70
		21,70
(a) Good Drainage		
1. Bondhead loam	G.B.P.	1,70
2. Bondhead sandy loam	G.B.P.	9,30
		11,00
(b) Imperfect Drainage		
1. Guerin loam	G.B.P.	1,30
(c) Poor Drainage		
1. Lyons loam	D.G.G.	3,70

II. Gravelly Loam Till

(a) Good Drainage		
1. Dummer loam	B.F.	33,00
2. Dummer loam—shallow phase	B.F.	63,20
		96,20

3. Soils Developed from Calcareous Lacustrine Clay Deposits over Calcareous Till

		Acreage
(a) Good Drainage		
1. Waupoos clay loam	G.B.P.	11,600
(b) Imperfect Drainage		
1. Solmesville clay loam	G.B.P.	19,800
(c) Poor Drainage		
1. Lindsay clay loam	D.G.G.	3,000

'. Soils Developed from Lacustrine Clay Deposits

I. Calcareous Materials.		
(a) Imperfect Drainage		
1. Smithfield clay loam	G.B.P.	11,400
(b) Poor Drainage		
1. Simcoe clay	D.G.G.	20,500
II. Non-Calcareous Material		
(a) Poor Drainage		
1. Atherley clay loam	D.G.G.	700

1. Soils Developed from Glacial Outwash

I. Calcareous Sandy or Gravelly Materials		
(a) Good Drainage		
1. Brighton sandy loam	G.B.P.	13,300
(b) Imperfect Drainage		
1. Tecumseth sandy loam	G.B.P.	4,300
(c) Poor Drainage		
1. Granby sandy loam	D.G.G.	5,600
II. Non-Calcareous Sandy Soils		
(a) Good Drainage		
1. Wendigo Sand	P	19,700
2. Wendigo Sand—stony phase	P	100
(b) Imperfect Drainage		
1. Mallard sandy loam	P	2,300
(c) Poor Drainage		
1. Kenabeek sandy loam	D.G.G.	1,300

E. Soils Developed from Calcareous Sand and Gravel in Kames and Eskers

(a) Good to Excessive Drainage		
1. Cramahe gravel	B.F.	10,100
2. Pontypool sandy loam	G.B.P.	1,700

F. Soils Developed from Calcareous Sand over Calcareous Till

(a) Good Drainage		
1. Dundonald sandy loam	G.B.P.	9,700

G. Soils Developed from Sand over Lacustrine Clay

		Acreage
I. Calcareous Materials		
(a) Good Drainage		
1. Bookton sandy loam	G.B.P.	20
(b) Imperfect Drainage		
1. Berrien sandy loam	G.B.P.	1,90
(c) Poor Drainage		
1. Wauseon sandy loam	D.G.G.	1,20
II. Non-Calcareous Materials		
(b) Imperfect Drainage		
1. Dalton sandy loam	P	4,70

H. Soils Developed from Shallow Loam and Clay Loam Till Deposits over Limestone Bedrock

(a) Variable Drainage		
1. Farmington loam	B.F.	63,00
2. Ameliasburg clay loam	G.B.P.	1,60

I. Rock Land 144,2

J. Soils Developed from Recent Alluvial Materials

(a) Variable Drainage		
1. Bottom land	A	5,4

K. Soils Developed from Organic Materials

(a) Very Poor Drainage		
1. Muck	B	54,9
2. Peat	B	

L. Flooded Land

1. Marsh	A	9.

KEY TO ABBREVIATIONS:

G.B.P.	—	Grey-Brown Podzolic	A	—	Alluvial
B.F.	—	Brown Forest	B	—	Bog
D.G.G.	—	Dark Grey Gleisolic			
P	—	Podzol			

Otonabee Series

The Otonabee soils are among the most important agricultural soils occurring in Victoria County. They are distributed fairly evenly over the County but occur principally in the west central part and in Eldon and Fenelon townships. They occupy an area of 133,800 acres or 15.5% of the County area. These soils are widely distributed in this region of the province, occurring in the adjacent counties of Peterborough and Ontario.

These soils are well drained both externally and internally. The topography varies somewhat in different parts of the County. In the vicinity of Lindsay the land is moderately rolling, but towards Peterborough the slopes are steeper and shorter, giving that area a more rugged appearance.

The soil parent material consists of a sandy loam textured glacial till containing a moderate amount of stone. This material is calcareous since it is derived principally from limestone rock. In general the texture of the surface soil is loam but in a number of areas the surface texture is sandy loam. Two types have therefore been mapped, namely, Otonabee loam and Otonabee sandy loam. Except for the surface these soils are very similar.

In the virgin or uncultivated state these soils possess a relatively deep and dark colored surface. In cultivated fields much of it has been lost through erosion and the lighter coloured material which was below now shows up particularly on the steeper slopes. As the finer material is removed by water the surface also becomes more stony.

Soil development shows some of the characteristics of both the Brown Forest Great Soil Group and of the Grey-Brown Podzolic soils. The A_2 horizon of the latter is missing but a fairly well developed textural B horizon is nearly always present. The thin solum is also one of the distinguishing characteristics of this soil compared with similar textured soils occurring in the southern parts of the province.

Following is a description of a virgin profile.

A_1 — 0–4″ very dark grey (10 YR 3/1) loam; granular and crumb structure; soft; even boundary; pH 6.8

B_1 — 4–8″ brown (7.5 YR 4/4) loam; weak small subangular blocky structure; friable consistency; pH 6.8

B_2 — 8–12″ very dark grey-brown (10 YR 3/2) clay loam; small subangular blocky structure; friable consistency; uneven boundary; few stones; pH 7.0

B_3 — 12–16″ dark grey-brown (10 YR 4/2) loam; weak subangular blocky structure; friable consistency; calcareous; pH 7.6

C — pale brown (10 YR 6/3) loam; calcareous; stony; pH 8.3

Utilization:

These soils are used for the growing of a wide variety of crops. Since the surface soils are friable and possess granular or crumb structure, they are easy to cultivate.

Profile of Otonabee loam showing thinness of solum and stony till materials.

Legumes flourish on the Otonabee Loam.

Victoria county is a mixed farming area with the main income being derived rom livestock. The latter consists mainly of beef cattle but some dairy herds are to e found in the vicinity of Lindsay. Although some cash crops such as winter wheat re grown, the principal crops are hay and oats which support the livestock ndustry. Corn is grown to some extent.

Fertilizers are used to some extent and are necessary for both hay and grain rops. The natural fertility of this soil is medium but increased yields can be btained by the use of phosphorus and potash supplements.

Otonabee Loam – shallow phase (25,500 acres)

The Otonabee loam — shallow phase has developed on relatively thin eposits of loamy till over limestone bedrock. Depth to bedrock varies from wo to four feet.

This phase has been mapped chiefly in Eldon, Fenelon and Emily Townships. he topography varies from gently to moderately sloping.

tilization:

This soil is used for general farming but is a less reliable soil than the deeper embers of the series.

Otonabee loam — steep phase. Water erosion is often serious on these soils.

Otonabee Loam – steep phase (8,000 acres)

Otonabee soils having slopes in excess of 15 per cent have been mapped a a steep phase.

They occur generally in the southern part of Emily Township.

Utilization:

Cultivation is difficult on these steep slopes. This is essentially pasture land and pasture crops could be improved on many areas by broadcasting a fertilizer mixture. This is done preferably in early spring every two or three years.

Emily Loam

The Emily soils are mapped in close association with the Otonabee series and are the imperfectly drained members of the Otonabee catena. Emily loam is the only type mapped and 19,000 acres of this soil has been delineated on the map. A considerable acreage of this soil has been included with the Otonabee series because the scale of mapping did not permit its separation. In addition 2,700 acres of a shallow phase of the Emily loam has been mapped. Bedrock underlies this phase at 15 to 24 inches.

These soils have gently sloping topography and are found in the lower topographical positions in association with the Otonabee soils. They therefore receive considerable surface run-off from this higher land and remain in a wate saturated condition for longer periods than the Otonabee soils.

The surface horizon in the uncultivated state is a deep (4 inches) dar horizon rich in organic matter. This organic material improves the physica characteristics of a soil and is a source of organic phosphorus and nitrogen.

In these soils, development has been less pronounced than in the Otonabe but they have the morphological characteristics of the Brown Forest soils.

The following is a profile description of this series.

A_e — 0–6″ very dark brown (10 YR 2/2) loam; granula structure; friable; pH — 7.2.

B_1 — 6–9″ very dark grey-brown (10 YR 3/2) loam; gra ular structure; friable; pH — 7.2.

B_2 — 9–12″ very dark grey-brown (10 YR 3/2) clay loan subangular blocky structure; friable; mottled; fr carbonates present; pH — 7.4.

C_1 — 12–15″ greyish brown (10 YR 5/2) loam; weak subangular blocky; mottled; calcareous; pH 7.8.

C_2 — Grey (10 YR 5/1) clay loam; stony; calcareous.

Utilization:

Emily loam is considered to be a good soil for the production of clov and timothy hay, ensilage corn and pasture grasses. The yields of spring grai may be poor in seasons of high rainfall but in normal seasons the drainage sufficiently good to permit these crops to mature. Tile drainage would grea improve the productivity of this soil.

Emily loam — shallow phase (2,700 acres)

This phase was mapped when bedrock occurred at a depth of fifteen inch to two feet below the surface. Other than this, the soil is similar to the norm Emily soils.

Utilization:

The underlying bedrock prevents deep rooting of most plants and may cause droughtiness in late summer.

Fair crops of hay and spring grain are grown on this soil.

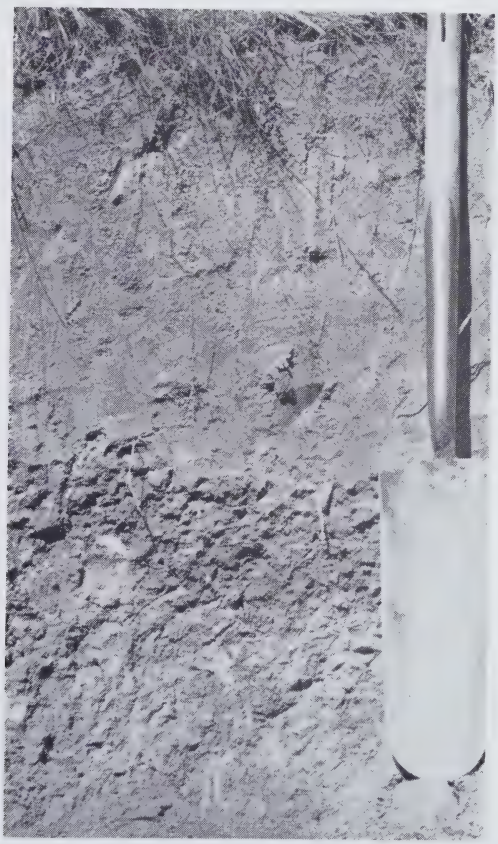
Bondhead Series

There are 11,000 acres of the Bondhead soils mapped in Victoria County. They are found in the southern parts of Emily and Mariposa townships. These soils are more widely distributed in the adjacent counties of Durham and Ontario.

These soils are well drained both externally and internally. The topography is moderately rolling.

The soil parent material consists of a loam or sandy loam textured glacial till that is moderately stony. This is calcareous material derived principally from Trenton limestone. The sandy loam textured Bondhead materials are found north of Lake Scugog and the loamy materials are found in Emily Township. Two types have been mapped, namely Bondhead loam and Bondhead sandy loam.

In the uncultivated state these soils have a dark surface horizon, a little shallower than that found in the Otonabee soils. The weathered part of the profile is deep and erosion must be severe before the light grey substratum appears at the surface.



Bondhead loam — The textural B horizon occurs at a depth of about seventeen inches.

Soil development is typically that of the Grey-Brown Podzolic soils with a relatively deep A_2 horizon and a well developed textural B horizon.

Following is a description of a virgin profile of the loam type.

A_1 — 0–4″ very dark grey (10 YR 3/1) loam; crumb structure; friable consistency; few stones; pH 7.1

A_2 — 4–17″ yellowish brown (10 YR 5/4) loam; crumb to weak platy structure; friable consistency; uneven boundary; few stones; pH 6.8.

B_2 — 17–21″ dark brown (7.5 YR 5/4) clay loam; subangular blocky structure; firm; uneven boundary; pH 7.0.

C — Grey-brown (10 YR 5/2) loamy calcareous till pH 8.2.

Utilization:

These soils are similar to the Otonabee in land use, and like them can be used for growing a wide variety of crops. They are early warm soils with a friable crumb or granular surface.

They are used for both beef and dairy types of farming and are very suitable for these enterprises. Clover and alfalfa hay, fall wheat and corn can be successfully grown.

Most crops respond to applications of superphosphate or a fertilizer mix high in phosphorus content. The steeper slopes should be retained as hay and pasture for longer periods in order to control erosion.

Bondhead Sandy Loam (9300 acres)

This soil type is found in the south western part of the county. Differences occur in the profile characteristics of the loam and sandy loam types as shown in the description given on pages 18 and 30.

Utilization:

Utilization of the Bondhead sandy loam is similar to that of the loam type.

However, it is a droughty soil and requires more careful management to attain yields equal to those obtained on the loam type. Every effort should be made to conserve moisture. The incorporation of all organic residues in the soil may help. In addition, the Bondhead sandy loam may require greater rates of fertilizer to reach a desirable fertility level.

Guerin Loam (1,300 acres)

Guerin loam has been mapped in association with the Bondhead sandy loam in the southwestern part of the county. It is the imperfectly drained member of the Bondhead catena and has sufficient development to be classed with the Grey-Brown Podzolic Great Soil Group.

The following is a detailed description:

A_e — 0–6″ very dark grey (10 YR 3/1) loam; crumb structure; very friable consistency; few stones pH — 7.2.

A_2 — 6–14″ yellowish brown (10 YR 5/6) loam; may have mottling in lower part of horizon; crumb structure; friable consistency; few stones; pH — 7.2.

B_2 — 14–18″ brown (7.5 YR 4/4) loam; mottled; subangular blocky; friable consistency; stony; pH — 7.4.

C — Grey-brown calcareous stony till.

The Guerin loam occurs in the slightly depressional areas between the mestone till ridges and also on smooth lower slopes.

tilization:

The value of these imperfectly drained soils can be improved by artificial rainage. In their present state they are suitable for only a few varieties of crops ch as clover, timothy hay, and spring grain. The yields of spring grains may e expected to be lower than those on the adjacent Bondhead soils, but hay elds may be higher in dry years.

Lyons Loam (3,700 acres)

The Lyons soils are the poorly drained soils associated with the Bondhead d Otonabee series. They occupy the level or slightly depressional areas between e drumlins and are therefore the catch basins for the water and eroded soil at runs down from the surrounding slopes. Since these areas are saturated th water for a large part of the year they tend to develop a deep dark surface h in organic materials. The subsoil is grey and mottled and lacks the horizon velopment characteristic of the better drained soils. It is classified as a Dark ey Gleisolic.

Following is a description of the Lyons profile.

A_c — 0–8″ black (10 YR 2/1) loam, crumb structure; some stones; pH 7.2

G_1 — 8–13″ grey (10 YR 5/1) loam; mottled; subangular blocky; friable; pH 7.2

G_2 — 13–18″ grey (10 YR 5/1) loam; mottled; large subangular blocky; friable; free carbonates; pH 7.4

C — Grey calcareous stony till; pH 8.2

lization:

The Lyons soils are not used to any extent for cultivated crops. Although ie areas are cultivated most of the land is used as pasture or left as woodlots. e chief problem connected with these soils is that of drainage. This condition l be difficult to improve because of the stoniness of the subsoil and their ressional positions. The cleared areas are suitable only for pasture.

Dummer Loam (96,800 acres)

This series, occupying almost 100,000 acres, represents about 11 per cent he total land area of the County. Of this acreage, 33,000 acres are mapped

as Dummer loam and the remainder, Dummer loam—shallow phase. These soil
are found in Verulam, Somerville and Laxton townships with a small acreag
mapped in Eldon township. Large areas of the Dummer soils are also found i
Peterborough, Northumberland and Hastings Counties.

Dummer loam — Improved by stone removal.

Dummer loam — unimproved.

These soils are well to excessively drained and the topography varies from oderately to steeply hilly where the till is deep. The soil parent materials are very stony loam till.

In the uncultivated state these soils have a dark surface horizon rich in rganic matter. The weathered part of the profile is thin and is characteristic the Brown Forest soils of Ontario.

Following is a description of a virgin profile.

A_1 — 0–3″ black (10 YR 2/1) loam; crumb structure; friable; even boundary; stony; free carbonates; pH — 7.4.

B_1 — 3–5″ very dark grey-brown (10 YR 3/2) loam; granular structure; friable; stony; free carbonates; pH — 7.4.

B_2 — 5–9″ dark brown (7.5 YR 3/2) clay loam; subangular blocky structure; friable; stony; free carbonates; pH — 7.8.

C — Grey-brown calcareous stony till.

ilization:

The Dummer soils are most suitable for pasture and are mainly used for is purpose. However, some areas, after extensive stone removal, have been ought under cultivation and are producing good to fair crops of hay and oats. rge holdings are required to make an economical farm unit as the cultivated lds are generally scattered and separated by the physical barriers of hills and k.

There is little likelihood of much future agricultural development of these ls except for grazing purposes.

Dummer Loam – shallow phase (63,800 acres)

The shallow phase of the Dummer loam has a relatively thin cover of till r the bedrock. The topography is undulating and a striking characteristic of phase are the numerous slabs of bedrock jutting out of the soil at various les.

This phase differs from the Farmington soils, which it otherwise resembles. that pockets of till materials frequently occur, which are over one foot in th. The phase is very stony.

lization:

This phase can only be used as ranch land or for forestry purposes. As ranch l it has a low carrying capacity.

OILS DEVELOPED FROM CALCAREOUS LACUSTRINE MATERIAL OVER CALCAREOUS TILL

The soils occurring on these materials occupy 34,400 acres or 3.9 per cent he County. There are three drainage members mapped, the well drained

to moderately well drained Waupoos, the imperfectly drained Solmesville and the poorly drained Lindsay soils.

Waupoos Clay Loam

The Waupoos soils are mapped mainly in the township of Ops and Mariposa. The 11,600 acres of this series represents only 1.3 per cent of the total land area of the County.

These soils are found on gently to moderately sloping ridges, which are surrounded by areas of nearly level land. In these soils, the profile surface has developed in limestone clay loam materials, which is underlain by stony calcareous till. The clay deposits originated during the time the area was covered by glacial lake Schomberg. Under cultivation many of the sloping fields have lost much of the clay deposit through erosion, and the underlying till is exposed.

These soils are well to moderately well drained and the profile development is classed as Grey-Brown Podzolic.

Profile of Waupoos clay loam. Note the stonefree clay solum over stony calcareous till.

The following profile description is a generalized description of these soils ıder virgin conditions.

A_1 — 0–3″ very dark grey (10 YR 3/1) clay loam; small granular structure; friable consistency; pH 6.8

A_2 — 3–8″ grey-brown (10 YR 5/2) clay loam; medium subangular blocky structure; friable consistency; pH 6.7

B_2 — 8–16″ brown (7.5 YR 4/2) clay; angular blocky; firm consistency; pH 6.9

D — Pale brown (10 YR 6/3) loam or clay loam; stony calcareous till; pH 7.8

ilization:

The Waupoos soils have a high level of natural fertility and produce good lds of the crops commonly grown in the County. Hay including clover and ılfa, fall wheat, spring grain and some corn are the crops normally grown.

These soils will remain in better tilth if liberal amounts of barnyard manure l other organic residues are frequently incorporated with the soil.

Solmesville Clay Loam

There are 19,800 acres of the Solmesville soils mapped in the County and greatest acreage is mapped in Mariposa and Ops Townships.

These soils have gently to very gently sloping topograhpy resulting in imper- drainage conditions within the soil profiles. Although generally there is at t a foot of lacustrine clay over the stony till, slight elevations occur in many ls where the clay deposit is very thin and stones appear on the surface.

The profile development is characteristic of the Grey-Brown Podzolic soils.

The following is a generalized description of the profile.

A_e — 0–7″ very dark brown (10 YR 2/2) clay loam; granular structure; friable consistency; pH — 7.3.

A_2 — 7–10″ dark grey-brown (10 YR 4/2) clay loam; subangular blocky; friable consistency; pH — 7.3.

B_2 — 10–14″ very dark grey-brown (10 YR 3/2) clay; mottled; subangular blocky structure; firm consistency; calcareous in lower part of horizon.

C — mottled, grey-brown; clay loam till; pH — 7.8.

ti ation:

These soils are somewhat inferior to the Waupoos soils because of drainage ut hey are normally capable of producing good crops of spring grains, hay and

ensilage corn. They have in the past produced large quantities of alsike clove seed. If the drainage is improved the Solmesville soils are less affected by we seasons and can produce a greater range of crops.

(c) Poor Drainage.

Lindsay Clay Loam (3,000 acres)

The Lindsay soils are developed on fine textured calcareous clay overlyin stony till. These soils are poorly drained and are classified as members of th Dark Grey Gleisolic Great Soil Group.

A_e — 0–6″ very dark grey (10 YR 3/1) clay loam; granula friable; free carbonates; pH 7.4

G_1 — 6–12″ pale brown (10 YR 6/3) clay loam; high mottled; weakly subangular blocky; firm; fr carbonates; pH 7.6

C_2 — Mottled grey calcareous clay till; very stony; pH 8.

The topography is smooth very gently sloping.

Utilization:

The Lindsay soils are used for hay and pasture. Such soils could be broug into a higher state of cultivation by drainage improvements.

C. SOILS DEVELOPED FROM LACUSTRINE DEPOSITS

I. Calcareous Materials

There are 31,900 acres of these lacustrine soils mapped in the County. Th represents 3.6 per cent of the total area.

The soils in this group are the imperfectly drained Smithfield series and t poorly drained Simcoe series.

Smithfield Clay Loam

The Smithfield soils occur in the old glacial lake bed in Mariposa and O townships principally. These soils have developed from calcareous lacustri clays laid down by glacial lake Schomberg. There are 11,400 acres of th soils mapped in the County. They are highly productive soils.

Smithfield clay loam is the only series member mapped in Victoria Coun This soil occurs on very gently sloping topography. Imperfect drainage conditio within the profile have arisen because of the inadequate surface drainage and sl internal drainage. They have relatively weakly developed characteristics of t Grey-Brown Podzolic soils.

The following profile description is representative of this soil type.

A_e — 0–5″ very dark grey (10 YR 3/1) clay loam; sm granular structure; friable consistency; pH 7.2

A_2 — 5–7″ dark grey-brown (10 YR 4/2) clay loam; medium subangular blocky structure; friable consistency; slightly mottled; pH 7.1

B_2 — 7–19″ very dark grey-brown (10 YR 3/2) clay; mottled; medium subangular blocky structure; firm consistency; pH 7.3

C — Grey-brown (10 YR 5/2) clay; angular blocky structure; firm consistency; pH 8.0

A landscape of Smithfield clay loam.

zation:

The Smithfield soils have a good level of natural fertility and are well lied with organic matter in the plow layer. The high levels of organic matter nd calcium result in good soil structure. Under natural drainage good crops f over and timothy hay can be produced. When under-drained, excellent yields an e obtained for all crops normally grown in the County.

Simcoe Clay

The soils mapped as Simcoe clay cover an area of 20,500 acres, most of which occ s in Mariposa and Ops townships. They are the poorly drained soils that occ y the level and slightly depressional areas in the Schomberg clay plain.

They occur on similar materials as the Smithfield but are differentiated from i on the basis of drainage.

Although these are poorly drained soils it should be recognized that the are potentially good agricultural soils. Some system of artificial drainage required to bring them into a higher state of production. The surface soil i neutral in reaction and relatively high in organic matter.

Following is a profile description of this series.

A_c — 0–8″ very dark grey (10 YR 3/1) clay; mediu subangular blocky structure; friable consistenc stonefree; pH 7.3.

G_1 — 8–24″ grey (10 YR 5/1) clay; mottled; weak angul blocky structure; firm; stonefree; pH 7.6.

G_2 — 24–36″ grey (10 YR 5/1) clay; very mottled; ma sive structure; pH 8.2.

C — Grey-brown (10 YR 5/2) clay; pH 8.3.

Simcoe clay is usually well supplied with organic matter in the plow layer as shown in this picture of a Simcoe profile.

Much of the Simcoe clay is in woodlot or natural pasture.

ilization:

The Simcoe soils are not cultivated to any great extent since no system of tificial drainage has been provided. Open ditches or tile drainage should take re of the excess water and under such management these soils would approach e Smithfield soils in their productivity.

Both dairy and beef types of farming occur in this area. If economic con-ions improve so that there is an expansion in these types of farming the ncoe soils are potential areas of development.

Atherley Clay Loam (700 acres)

The Atherley clay loam soils have developed from less calcareous clay de-sits than those which formed the Smithfield and Simcoe soils. The soil is refore slightly acid to a depth of 18 or 20 inches, and becomes neutral with ater depth.

The acreage mapped in Victoria County is small but the soils are part of arger lacustrine basin occurring in Ontario county to the west. They are nd in small level areas north and west of the town of Lorneville.

These soils are poorly drained and are classified as Dark Grey Gleisolic.

e description of the profile is as follows.

A_e— 0–8″ very dark grey (10 YR 3/1) clay loam; granular structure, friable; pH 6.8.

G — 8–18″ grey (10 YR 5/1) clay; mottled; blocky struc
ture; pH 6.8.

C — Grey clay; pH 7.0.

Utilization:

The Atherley soils are used almost exclusively for pasture and woodlot except where drainage has been provided by means of open ditches, in thes cases hay crops are being grown successfully. In many places the reaction of th surface soil is as low as a pH of 6.0. Under such conditions liming as well a artificial drainage may be necessary in order to grow crops satisfactorily.

D. SOILS FORMED FROM GLACIAL OUTWASH

The soils under this heading have developed from sands originating outwash materials. A further subdivision has been made as follows, soils develope from calcareous sands and soils developed from non-calcareous sands.

I. Calcareous Sandy Material

The soils developed from calcareous sands in Victoria County have bee correlated with the Brighton catena. These are the well drained Brighton, t imperfectly drained Tecumseth and the poorly drained Granby soils.

Brighton Sandy Loam

The Brighton sandy loam makes up an area of 13,300 acres. These so occur in scattered areas over the southern half of the County.

They have gentle to moderately sloping topography and both internal a external drainage is good. The soil parent material consists of sand with high proportion of limestone.

The profile development has the characteristics of a Grey-Brown Podzo soil with evidence of a Podzol development occurring in the upper part of profile.

The following profile description is representative of this soil.

A_0 — 0–6″ very dark grey (10 YR 3/1) sandy loam; cru structure; very friable; pH 6.0.

A_{21} — 6–12″ reddish brown (5 YR 4/4) sand; weak cru structure; very friable; pH 6.0

A_{22} — 12–25″ pale brown (10 YR 6/3) sand; weak p structure; very friable; pH 6.3.

B_2 — 25–26″ reddish brown (5 YR 4/4) sandy lo crumb structure; friable; pH 7.0.

C_2 — Pale brown (10 YR 6/3) calcareous sands; pH

A landscape of Brighton sandy loam.

tilization:

The Brighton soils are cleared and used fairly extensively for agricultural urposes. Such crops as fall wheat, rye, oats, corn, timothy, clover and alfalfa re being grown. In the southern part of the County such specialized crops as otatoes, tomatoes and small fruits are also grown.

In general, these soils can be considered as having a low natural fertility nd low moisture holding capacity. The use of barnyard manure or the ploughing own of green manuring crops such as sweet clover should be a part of the neral farm practice in order to maintain the organic matter content. Increased elds of the various crops can also be expected from the application of com-ercial fertilizers.

) Imperfect drainage.

Tecumseth Sandy Loam (4,300 acres)

This soil has developed on well sorted calcareous outwash sand. It is the perfectly drained member of the Brighton catena. The type is mapped in hily, Verulam, and Ops Townships.

A_e — 0–6″ very dark grey (10 YR 3/1) sandy loam; crumb structure; very friable; even boundary; pH — 7.2.

A_2 — 6–18″ yellowish brown (10 YR 5/6) sand; structureless; pH 7.0.

B_2 — 18–22″ mottled; brown (10 YR 3/2) loam; sub-angular blocky structure; very friable; pH — 7.2.

C_2 — Greyish mottled calcareous sand.

The topography is smooth very gently sloping to smooth gently sloping.

Utilization:

Fertility and drainage are the two factors limiting the productivity of this soil. Some fair crops of fall wheat, rye, oats, tomatoes and small fruits are being grown.

(c) Poor drainage

Granby Sandy Loam (5,600 acres)

The Granby soil has developed on well sorted calcareous outwash sand It is the poorly drained member of the Brighton catena and is classified as a member of the Dark Grey Gleisolic Great Soil Group.

This soil type has been mapped in Emily, Ops, Mariposa, Fenelon and Eldon Townships. Following is a description of a representative profile.

A_c — 0–9″ very dark brown (10 YR 2/2) sandy loam crumb structure; very friable; pH — 7.3; some fre carbonates.

G_1 — 9–17″ grey (10 YR 6/1) mottled sand; single grai structure; pH — 7.4 free carbonates.

Profile of Granby sandy loam. Note the dark surface horizon rich in organic matter.

G_2 — 17–27″ light brownish grey (10 YR 6/2) mottled sand; single grain structure; free carbonates.

C_2 — Grey, calcareous sand.

The Granby sandy loam is essentially stonefree, although some boulders may asionally be found.

lization:

Very little of the Granby soil is under cultivation, most of it is in permanent ture or woodlot.

Non-Calcareous Sandy Material

The non-calcareous sandy materials are found in the northern part of the unty. They are derived from the granites, gneisses, etc., which form the Pre-nbrian shield.

Three drainage classes are mapped, the well drained Wendigo, imperfectly ined Mallard, and poorly drained Kenabeek.

Wendigo Sand

In Victoria County there are 19,700 acres of the Wendigo soils and there is onsiderable acreage of these soils across the northern parts of Ontario, Peter-rough and Hastings Counties. They take their name from similar soils found Northern Ontario.

The Wendigo soils are well drained and found on gently to moderately ping topography. They are classified as Podzol soils but the A_2 horizon is not tinuous in this County.

The following profile description is representative of the type.

A_0 — Loose covering of leaf litter.

A_2 — 0–2″ white (10 YR 8/1) sand; single grain structure; loose consistency; pH — 5.0.

B_{21} — 2–6″ very dark grey-brown (10 YR 3/2) sandy loam; crumb and granular structure; soft; pH — 5.8.

B_{22} — 6–11″ dark yellowish brown (10 YR 4/4) sandy loam; granular structure; very friable; pH — 6.2.

C_1 — 11–17″ yellowish brown (10 YR 5/6) sand; single grain; pH — 6.8.

C_2 — Pale brown (10 YR 6/3) sand; no free carbonates; pH — 7.0.

The topography is smooth, gently sloping.

zation:

Much of the Wendigo sand mapped in Victoria County was at one time vated but large areas have been abandoned and are being reforested. It is in organic matter and the fertility level is well below the requirements of n and hay crops. It is a very droughty soil and at present it would seem to ore valuable as a forest soil than an agricultural soil.

Profile of Wendigo Sand.

Reforestation plot on Wendigo Sand

Wendigo sand – stony phase (100 acres)

This small area was mapped in the vicinity of Lower Mud Lake in the northern part of the County. It is in close association with the stony Dummer loam and is a boulder strewn sandy deposit.

Utilization:

Stones have been picked and the area is under cultivation. Other than stoniness it has similar characteristics to the Wendigo sand.

b) Imperfect drainage

Mallard Sandy Loam (2,300 acres)

The Mallard sandy loam is the imperfectly drained member of the Wendigo catena. It occurs chiefly in the northern part of Eldon Township. It has the profile characteristics of the Podzol soils.

In the following description the A_2 horizon has been destroyed by cultivation.

A_e — 0–6″ sandy loam; brown (10 YR 5/3) weak crumb structure; friable; pH — 5.0.

B_{21} — 6–17″ sand; yellowish brown (10 YR 5/6) mottled; weak crumb structure; friable; pH — 5.0.

B_{22} — 17–30″ sand; brownish yellow (10 YR 6/6) mottled; weak crumb structure; friable; pH — 5.2.

C — Sand; pale brown (10 YR 6/3) pH — 5.6.

The topography is very gently undulating.

Utilization:

Imperfect drainage, low fertility and acid reaction reduce the crop productivity of the Mallard soils. For this reason most of the type is used as permanent pasture.

c) Poor drainage

Kenabeek Sandy Loam (1,300 acres)

The Kenabeek sandy loam is the poorly drained member of the Wendigo catena and is classified as a Dark Grey Gleisolic Soil.

A_e — 0–5″ sandy loam; dark greyish brown (10 YR 4/2) crumb structure; friable; pH — 5.0.

G_1 — 5–17″ sand; light brownish grey (10 YR 6/2) mottled; structureless; pH — 5.2.

G_2 — 7–17″ sand; light brownish grey (10 YR 6/2) severely mottled; structureless; pH — 5.2.

C — Sand; pale brown (10 YR 6/3); pH — 5.4.

The topography is nearly level permitting very little run-off. Vegetation consists of white cedar, poplar, spruce and balsam.

Utilization:

The Kenabeek soils are chiefly in woodlot with some permanent pasture. Poor drainage, low fertility and acidity make it a poor agricultural soil.

E. SOILS DEVELOPED FROM KAMES AND ESKERS

(a) Good to excessive drainage.

Cramahe Gravel (10,100 acres)

The Cramahe soils mapped in Victoria County are generally found in long ridges known as eskers. The materials are coarse calcareous sand and gravel, cobbles and larger boulders. This series is mapped in small areas throughout the County and is classified as a Brown Forest Soil.

A_1 — 0–4″ very dark brown (10 YR 2/2) gravelly sandy loam; granular structure; friable; free carbonates; pH — 7.5.

B_1 — 4–8″ dark yellowish brown (10 YR 4/4) gravelly sandy loam; weakly subangular blocky structure; friable; free carbonates; some stones; pH — 7.5.

Soils developed on gravel ridges as shown in the illustration are called Cramahe gravel.

B_2 — 8–11″ reddish brown (5 YR 4/3) gravelly sandy loam; subangular blocky structure; friable; stony; free carbonates; pH — 7.8.

C_2 — Calcareous poorly sorted gravel; pH — 8.2.

The topography is irregular steeply sloping. The Cramahe soils are very tony, and drainage is excessive.

Utilization:

The coarseness of the materials, and steep slopes make cultivation impractical. Such soils are only fair pasture soils and would serve a more useful purpose used as woodlots. They are important sources of gravel for road building.

Pontypool Sandy Loam (1,700 acres)

The Pontypool soils have developed on calcareous sands and gravel. Removal f the forest cover and subsequent cultivation has resulted in severe wind and ater erosion. It has been mapped in Eldon Township and is classified as a Grey-rown Podzolic soil.

ESCRIPTION:

A_1 — 0–3″ very dark grey (10 YR 3/1) sandy loam; crumb structure; friable; pH — 7.1.

A_{21} — 4–12″ dark yellowish brown (10 YR 4/4) sand; very weakly platy; friable; pH — 6.8.

A_{22} — 12–20″ yellowish brown (10 YR 5/6) sand; single grain; pH — 6.8.

B_2 — 20–22″ reddish brown (5 YR 4/4) sandy loam; very weak subangular blocky structure; pH — 7.2.

C_2 — (10 YR 5/2) grey-brown calcareous sand.

The topography is steeply hilly. Surface run-off is medium and internal drain-ge is very rapid.

Utilization:

Most of the Pontypool mapped in Victoria County is not suited for the g wing of crops. It is presently in woodlot or permanent pasture.

SOILS DEVELOPED ON CALCAREOUS SAND OVER LIMESTONE TILL

(Good drainage

Dundonald Sandy Loam (9,700 acres)

The Dundonald soils are developed on sandy outwash materials overlying a lcareous loam to clay loam till. They are well drained and have the character-ist s of the Grey-Brown Podzolic Great Soil Group. They occur in Emily, Ops ar Mariposa Townships, and occupy a relatively small acreage.

A_c — 0–4″ dark grey-brown (10 YR 4/2) sandy loam; crumb structure; friable; pH — 7.2.

A_{21} — 4–8″ dark yellowish brown (10 YR 4/4) sand; granular structure; friable consistency; pH — 7.0.

A_{22} — 8–14″ yellowish brown (10 YR 5/4) sand; platy structure; friable; pH — 7.0.

B_2 — 14–18″ dark reddish brown (5 YR 3/2) clay loam; subangular blocky structure; friable; pH — 7.4; carbonates.

D — Grey calcareous medium textured till.

The depth of sand over till may reach 24-30″ and surface reaction may vary from 6.2 to 7.2.

The topography is gently rolling. These soils are stonefree to slightly stony

Dundonald sandy loam soil profile. Slightly deeper than normal.

tilization:

The slightly rolling topography, few stones, and fine materials within reach f the deeper rooted plants are good characteristics of this soil type. Crops rown on this soil should respond to a complete fertilizer mixture. The organic natter level must be maintained by green manuring practices and applications f barnyard manure. Lime may be used to an advantage as a starter for alfalfa nd clover. A soil test will indicate whether it is needed.

. SOILS DEVELOPED FROM SAND OVER LACUSTRINE CLAY

a) Good drainage

Bookton Sandy Loam (200 acres)

The Bookton soils are developed from sand overlying calcareous stonefree ay. The Bookton is well drained and has the characteristics of the Grey-Brown odzolic soils. Other catenary members are the Berrien which is imperfectly ained and the Wauseon which is the poorly drained member. All three members the catena are found in the County.

A_e — 0–6″ very dark grey (10 YR 3/1) sandy loam; crumb structure; very friable; pH 6.9.

A_{21} — 6–20″ yellowish brown (10 YR 5/6) sandy loam; weakly platy structure; very friable; pH 6.9.

A_{22} — 20–22″ pale brown (10 YR 6/3) sand; platy structure; friable; pH 6.8.

B_2D — 22–29″ brown (7.5 YR) clay; subangular blocky structure; firm consistency; pH 7.4.

D — Grey calcareous stonefree clay.

The topography is gently rolling.

Ulization:

Bookton sandy loam is used for general farming in Victoria County. The sa dy overburden is low in plant nutrients but the underlying clay is better su plied. This type is fairly well suited to the production of cereal grains, hay an pasture. Vegetables and small fruits should do well.

Bookton sandy loam is an early soil; it is easy to work and is stonefree.

(a Imperfect drainage

Berrien Sandy Loam (1,900 acres)

Berrien sandy loam has developed from calcareous sand underlain by stone- fre clay at a depth of 24 to 30 inches. Berrien sandy loam is the imperfectly

drained member of the Bookton catena. A small total acreage of this type has been mapped in the southern part of Mariposa and Ops Townships.

A_c — 0–7" very dark grey (10 YR 3/1) sandy loam; crumb structure; very friable; pH — 7.1.

A_2 — 7–24" yellowish brown (10 YR 5/4) sandy loam; mottled in lower part of horizon; very weak granular structure; pH — 7.2.

B_2 — 24–25" dark brown (10 YR 4/3) loam; granular structure; friable; pH — 7.4.

D — Grey, calcareous; stonefree clay.

The topography is smooth gently sloping.

Utilization:

Most of this soil is under cultivation. Red and alsike clover and oats grow fairly well. The Berrien sandy loam is low in plant nutrients and requires fertilizer supplements, especially phosphorus and potash.

(c) Poor drainage

Wauseon Sandy Loam (1,200 acres)

The Wauseon soils are developed from sandy outwash over lacustrine clay. The profile has the characteristics of the Dark Grey Gleisolic Great Soil Group. The soil type occurs in Emily, Ops and Mariposa Townships.

A_c — 0–8" very dark grey (10 YR 3/1) sandy loam; granular structure; friable; free carbonates.

G — 8–21" mottled grey (10 YR 5/2) sand; single grain structure; friable consistency; free carbonates.

D — Mottled grey-brown (10 YR 5/2) clay; varved; free carbonates.

The sandy overburden may range in depth from 12" to 24".
The topography varies from level to very gently sloping.

Utilization:

Under natural drainage conditions the Wauseon soils will not grow farm crops economically. They are presently serving a useful purpose in woodland and permanent pasture.

II. Non-Calcareous Sand Over Lacustrine Clay

(a) Imperfect drainage

Dalton Sandy Loam (4,700 acres)

The Dalton sandy loam has developed from non-calcareous sand over neutral stonefree clay. It is an imperfectly drained soil and there are no other catenal

nbers mapped in the County. It is found within the Precambrian shield. The file has the characteristics of a Podzol.

A_0 — 0–6″ dark grey (10 YR 4/1) sandy loam; granular structure; friable; pH — 5.6.

A_2 — 6–8″ grey sand; single grain structure; pH — 5.2.

B — 8–20″ dark brown (7.5 YR 4/4) sandy loam; severely mottled horizon; iron concretions; pH — 7.3.

C — 20–30″ yellowish brown sand; non-calcareous.

D — Stonefree neutral clay.

There is some variation in depth of sand over clay.

lization:

The Dalton sandy loam produces fair crops of hay and fair to poor crops oats. Improvement of drainage will increase the yields of these crops and mit an extension of the types of crops grown. Applications of lime should be le before clover crops are grown.

SOILS FORMED FROM SHALLOW TILL OVER LIMESTONE BEDROCK

Farmington Loam (63,000 acres)

The Farmington soils have less than one foot of glacial till over limestone ock. They occur as broad level table lands, broken by the occasional escarpt or rock ledge. Most of the Farmington soils are found in Carden, Eldon Verulam Townships.

Some of the area mapped as Farmington has little or no till over the rock generally there are several inches of cover. The following profile description s that the profile developed in the shallow till of these soils is a Brown st soil.

A_1 — 0–3″ dark grey (10 YR 4/4) loam; crumb structure; friable; pH — 6.5.

B_1 — 3–8″ yellow-brown (10 YR 5/3) loam; subangular blocky structure; friable; pH — 6.7.

B_2 — 8–10″ brown (7.5 YR 5/4) loam; subangular blocky structure; friable; pH — 7.1.

D — limestone bedrock.

These soils are frequently saturated with water after heavy rains and in mmer are droughty.

Farmington loam landscape with limestone outcrop in the foreground.

Utilization:

The land is used for grazing. As grazing land these soils produce fair past during spring and fall but pasture vegetation burns up badly during the sum months. This naturally reduces the carrying capacity. Many farms have la ranches on the Farmington soils for summer pasture. This is its only agricultu value.

Ameliasburg Clay Loam (1,600 acres)

The Ameliasburg soil materials originated from shallow clay till depo over limestone. Ameliasburg clay loam is the only type mapped in the Cou

This stony clay loam soil is found mostly in the northern half of Marip Township.

The thinly bedded limestone is less than two feet from the surface. Th soils are moderately well drained and are Grey-Brown Podzolic soils.

A generalized profile description is given below.

A_e — 0–6″ very dark grey-brown (10 YR 3/2) shi clay loam; crumb structure; numerous small li stone fragments; pH 7.8; free carbonates.

A_2 — 6–10″ dark grey-brown (10 YR 4/2) clay loam; angular blocky structure; friable consistency; st pH 7.8.

B — 10–15″ reddish brown (5 YR 4/3) shingly clay lo subangular blocky structure; friable; frequent ments of limestone; pH — 7.9; free carbonates

D — Loose broken limestone bedrock with shale part

The topography of the Ameliasburg clay loam ranges from smooth gently ping to smooth moderately sloping.

lization:

The Ameliasburg clay loam is used for general farming in Victoria County. produces good yields of oats, fall wheat and hay crops in years of ample isture. In dry seasons yields are low.

Water erosion has produced a very stony surface layer which lowers crop lds and is hard on farm machinery.

ROCK LAND (144,200 acres)

A large area in the north of the County has been mapped as Rock Land. n to twenty-five per cent of the area is composed of Muck and Wendigo sand. e remainder is shallow sand and rock outcrop.

Rock Land.

Jtil ation:

xcept for a few areas of Wendigo sand this Rock Land is non-agricultural nd erves its most useful purpose in producing lumber and for recreation.

J. RECENT ALLUVIAL SOILS

Bottom Land (5,400 acres)

Areas of land adjoining stream courses have been mapped as Bottom Lan Such land is subject to flooding and a great variety of recent alluvial materi has been deposited. The reaction, texture, and depths are variable.

Utilization:

This soil is used chiefly for permanent pasture.

K. ORGANIC SOILS

Peat (100 acres)

A small area of Peat was mapped about two miles east of Woodville.

Originally it was much larger in extent but considerable burning has be done to bring the underlying clay into cultivation. The reclaimed land has the characteristics of Simcoe clay described elsewhere in this report.

The Peat deposit is several feet in thickness and is composed of undecompo woody organic material.

It is likely that eventually the remaining area will be burned off and brou under cultivation.

Typical vegetation on the organic soils in the County.

Muck (54,900 acres)

The organic deposits are found in old glacial spillway channels and depressional areas. They have eighteen or more inches of organic material

ying the mineral soil. The organic material is the partially decomposed remains f sedges and trees.

The muck soils have not been utilized for agriculture in the County and are overed by tree vegetation.

. FLOODED SOILS

Marsh (9,000 acres)

The marsh land borders lakes and streams and is low lying land which is nder water most of the year. It supports a vegetation of cattails, reeds and other ater-loving plants.

AND USE RATINGS FOR THE SOILS OF VICTORIA COUNTY

The crops grown in Victoria County are for the most part, those which by tal and error have proven to be suitable to the climate and soils. Some soils ze not suitable for producing the optimum growth of specific crops, e.g. alfalfa ces not thrive on acid soils nor flax on sandy soils. The land use ratings listed in tis section are given for the crops commonly grown in the County. They are sed on the physical and chemical characteristics of the soil. These characteristics include such features as topography, erodibility, stoniness, drainage, texture, organic matter content, structure, level of natural fertility and water holding capacity. During the course of the survey considerable information was obtained fm farmers regarding crop yields on various soil types and this information h also been used in evaluating the soils.

This rating has been developed to apply to crops commonly grown in the ar under average management practices. It also applies to an entire soil type an not to any specific area, or farm, where better than average management or proximity to market may influence crop yield or land value.

The soils of Victoria County have been placed into six groups on the basis of heir suitability for the growing of agricultural crops.

GROUP I. GOOD CROPLAND

Soil Type	Acreage	% Total Acreage of County
Waupoos clay loam	11,600	1.6
Bondhead loam	1,700	0.2
Otonabee loam	102,900	14.6
Smithfield clay loam	11,400	1.6
Solmesville clay loam	19,800	2.9
		20.9

Under average conditions the soils listed in Group I produce good yields of the farm crops generally grown in the County. The Bondhead and Otonabee are dependable soils. The Smithfield and Solmesville soils under natural drainage will give high yields with ideal moisture conditions but in wet seasons yields will be greatly reduced. When tiled, they will outyield the Otonabee and Bondhead soil

GROUP II. GOOD TO FAIR CROPLAND

Soil Type	Acreage	% Total Acreage of County
Dundonald sandy loam	9,700	1.3
Bondhead sandy loam	9,300	1.3
Otonabee sandy loam	13,000	1.8
Bookton sandy loam	200	0.02
Emily loam	19,000	2.8
Guerin loam	1,300	0.2
Ameliasburg clay loam	1,600	0.2
		7.6

The top four soils in the group are very similar in land use capabilitie They have a lower moisture holding capacity and a lower productivity level tha the soils in group I. Crop failures in wet seasons may occur on Emily and Gueri soils.

GROUP III. FAIR CROPLAND

Soil Type	Acreage	% Total Acreage of County
Brighton sandy loam	13,300	1.9
Otonabee loam — shallow phase	25,500	3.6
Simcoe clay	20,500	2.9
Lindsay clay loam	3,000	0.4
		8.8

The soils in this group have different characteristics limiting crop grow The Brighton sandy loam has a low moisture holding capacity and is low fertility. The Otonabee loam—shallow phase is droughty in midsummer. T Simcoe and Lindsay soils are poorly drained and are unreliable for producti of spring grain but are suitable for hay and pasture.

GROUP IV. FAIR TO POOR CROPLAND

Soil Type	Acreage	% Total Acreage of County
Tecumseth sandy loam	4,300	0.7
Berrien sandy loam	1,900	0.2
Atherley clay loam	700	0.1
		1.0

Inadequate drainage and low fertility are the limiting characteristics of Tecumseth and Berrien soils. The Atherley soils are poorly drained and low lime.

GROUP V. POOR CROPLAND

Soil Type	Acreage	% Total Acreage of County
Otonabee loam—steep phase	8,000	1.1
Emily loam—shallow phase	2,700	0.4
Lyons loam	3,700	0.5

Soil Type	Acreage	% Total Acreage of County
Dummer loam	33,000	4.6
Granby sandy loam	5,600	0.8
Mallard sandy loam	2,300	0.3
Dalton sandy loam	4,700	0.8
Pontypool sandy loam	1,700	0.2
Kenabeek sandy loam	1,300	0.2
		8.9

This group of soils is used mostly for pasture or woodlot. Some can be improved and used for Agricultural crops. For example the Granby if underdrained may be used for vegetable growing, etc.

GROUP VI. NON-AGRICULTURAL LAND

Soil Type	Acreage	% Total Acreage of County
Bottom land	5,400	0.7
Wendigo sand and stony phase	19,800	2.9
Wauseon sandy loam	1,200	0.2
Cramahe gravel	10,100	1.4
Farmington loam	63,000	8.9
Dummer loam—shallow phase	63,800	9.0
Rock land	144,200	20.6
Muck	54,900	7.8
Peat	100	0.1
Marsh	9,000	1.2
		52.7

These soils are non-agricultural except for pasture. Most of them have physical characteristics which prevent cultivation and the organic soils have not been developed for agriculture.

TABLE 7

LAND USE RATINGS FOR THE SOILS OF VICTORIA COUNTY

	Fall Wheat Bu./ac.		Oats Bu./ac.		Barley Bu./ac.		Alfalfa Tons/ac.		Red Clover Tons/ac.		Timothy Tons/ac.		Improved Pasture 1=one 1000 lb. steer/ac.		Corn Ensilage Tons/ac.		Corn Husking Bu./ac.	
	ND	TD	ND	TD	ND	TD	ND	TD	ND	TD	ND	TD	ND	TD	ND	TD	ND	TD
Good Cropland																		
Waupoos clay loam	40	—	50	—	35	—	3	—	2½	—	2½	—	1	—	12	—	50	—
Bondhead loam	40	—	50	—	30	—	3	—	2	—	1½	—	¾	—	12	—	50	—
Otonabee loam	35	—	50	—	30	—	3	—	2	—	1½	—	¾	—	11	—	45	—
Smithfield clay loam	25	60	30	60	20	40	½	2½	2½	—	2½	—	1	—	9	14	40	70
Solmesville clay loam	25	60	30	60	20	40	½	2½	2½	—	2½	—	1	—	9	14	40	70
Good to Fair Cropland																		
Dundonald sandy loam	35	—	40	—	25	—	2	—	2	—	2	—	½	—	11	—	50	—
Bondhead sandy loam	35	—	40	—	25	—	2	—	2	—	2	—	½	—	11	—	50	—
Otonabee sandy loam	30	—	35	—	20	—	2	—	2	—	2	—	½	—	10	—	40	—
Bookton sandy loam	25	—	35	—	20	—	2	—	2	—	2	—	½	—	10	—	40	—
Emily loam	20	40	30	50	20	40	1	3	2	—	2	—	½	—	8	12	40	60
Guerin loam	20	40	30	50	20	40	1	3	2	—	2	—	½	—	8	12	40	60
Ameliasburg clay loam	20	—	40	—	26	—	2	—	2	—	2	—	½	—	8	—	—	—
Fair Cropland																		
Brighton sandy loam	20	—	30	—	25	—	1	—	—	—	—	—	—	—	—	—	—	—
Otonabee loam—shallow phase	20	—	30	—	20	—	1½	—	—	—	—	—	—	—	—	—	—	—
Simcoe clay	—	40	20	60	—	35	—	2½	¾	2½	1½	2½	½	1	5	12	—	50
Lindsay clay loam	—	40	20	60	—	35	—	2½	¾	2½	1½	2½	½	1	5	12	—	50

	Fall Wheat Bu./ac.		Oats Bu./ac.		Barley Bu./ac.		Alfalfa Tons/ac.		Red Clover Tons/ac.		Timothy Tons/ac.		Improved Pasture 1=one 1000 lb. steer/ac.		Corn Ensilage Tons/ac.		Corn Husking Bu./ac.	
	ND	TD	ND	TD	ND	TD	ND	TD	ND	TD	ND	TD	ND	TD	ND	TD	ND	TD
Fair to Poor Cropland																		
Tecumseth sandy loam	15	25	20	35	20	25	—	1½	1	1½	1	1	½	½	5	8	20	40
Berrien sandy loam	15	25	20	35	20	25	—	1½	1	1½	1	1	½	½	5	8	20	40
Atherley clay loam	—	—	20	40	—	25	—	1½	1	2	2	2	½	1	5	11	—	—
Poor Cropland																		
Otonabee loam-steep phase	—	—	20	—	20	—	2	—	1½	—	2	—	½	—	—	—	—	—
Emily loam-shallow phase	—	—	20	—	—	—	1½	—	1½	—	1½	—	½	—	—	—	—	—
Lyons loam	—	—	20	—	—	—	—	—	—	—	1½	—	½	—	—	—	—	—
Dummer loam	—	—	—	—	—	—	—	—	—	—	—	—	½	—	—	—	—	—
Granby sandy loam	—	—	20	—	—	—	—	—	—	—	1	—	⅛	—	—	—	—	—
Mallard sandy loam	—	—	20	—	—	—	—	—	1	—	1	—	⅛	—	—	—	—	—
Dalton sandy loam	—	—	20	—	—	—	—	—	1	—	1	—	⅛	—	—	—	—	—
Pontypool sandy loam	—	—	—	—	—	—	—	—	—	—	½	—	⅛	—	—	—	—	—
Kenabeek sandy loam	—	—	—	—	—	—	—	—	—	—	—	—	⅛	—	—	—	—	—
Non-Agricultural land																		
Bottom land	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—
Wendigo sand	—	—	—	—	—	—	—	—	—	—	½	—	1/16	—	—	—	—	—
Cramahe gravel	—	—	—	—	—	—	—	—	—	—	—	—	1/16	—	—	—	—	—
Farmington loam	—	—	—	—	—	—	—	—	—	—	—	—	1/16	—	—	—	—	—
Dummer loam-shallow phase	—	—	—	—	—	—	—	—	—	—	—	—	1/16	—	—	—	—	—
Rock land	—	—	—	—	—	—	—	—	—	—	—	—	1/16	—	—	—	—	—
Muck	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Peat	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Marsh	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

ND—normal drainage
TD—tile drainage

APPENDIX
Analytical Methods

Particle Size Distribution —

Bouyoucos Hydrometer Method. Soil Science. Vol. 42, 1936.

Note: A controlled temperature bath was used maintaining a temperatu
of 67° F.

Organic matter was not destroyed.

Reaction ..... Glass electrode.

Organic Matter Allison, L.E., "Organic Soil Carbon by Reduction
Chromic Acid." Soil Science, Vol. 40, 1935. p. 311.

The organic matter data was obtained by applying the factor 1.724 to the per ce
of organic carbon.

Moisture Equivalent — Briggs, L.S. and McLane, J.W. The moisture equivale
of soils. U.S.D.A. Bur. of Bull. 45, 1907.

PHYSICAL ANALYSES OF SEVERAL PROFILES FROM VICTORIA COUNTY

Soil Type	Horizon	Mechanical Analysis				Soil Reaction pH	Organic Matter Per Cent	Max. Water Holding Cap. Per Cent	Moisture Equivalent Per Cent
		Depth In.	Sand Per Cent	Silt Per Cent	.002mm. Clay Per Cent				
1 Otonabee	A_1	0-5	55	33	12	6.0	12.5	80	37
	B_1	5-10	55	29	16	6.6	4.8	53	24
	B_2	10-12	53	26	21	7.3	2.4	48	22
	C	—	58	23	19	7.9	0.3	26	13
2 Otonabee	A_1	0-3	41	42	17	6.8	15.8	60	42
	B_1	3-9	53	30	17	7.0	2.5	44	19
	B_2	9-11	47	20	33	6.8	1.8	45	23
	C	—	52	31	17	7.8	0.4	30	13
3 Otonabee	A_1	0-4	42	43	15	6.6	12.5	66	37
	B_1	4-10	42	43	15	6.3	4.3	52	25
	B_2	10-14	39	31	30	6.9	2.5	49	25
	C	—	67	27	16	7.8	1.1	30	13
4 Waupoos	A_1	0-3	22	46	32	7.2	5.4	60	40
	A_2	3-8	16	43	41	7.0	1.6	44	19
	B_2	8-16	15	34	51	6.9	1.6	44	23
	D	—	34	35	31	7.7	0.8	32	13
5 Waupoos	A_1	0-3	23	56	21	6.6	11.8	59	37
	A_2	3-6	20	44	36	6.0	2.8	39	24
	B_2	6-14	10	21	69	5.7	1.3	53	24
	D	—	48	34	18	7.8	0.4	30	12

*All profile samples were collected from woodlot sites.

DESCRIPTIONS OF PROFILES IN APPENDIX TABLE I

All profiles from woodlots of maple, beech association.

PROFILE 1 — Otonabee — Location, Mariposa Township, Con. X, Lot. 7.

A_1 — 0–5″ dark brown (10YR4/3) loam; crumb structure; friable

B_1 — 5–10″ brown (10YR5/3) loam; subangular blocky structure friable.

B_2 — 10–12″ brown (10YR5/3) clay loam; subangular block structure; friable.

C — Very pale brown calcareous till.

PROFILE 2 — Otonabee — Location, Eldon Township, Con. IX, Lot. 7.

A_1 — 0–3″ very dark brown (10YR2/2) loam; crumb structure friable.

B_1 — 3–9″ yellow-brown (10YR5/4) loam; subangular block structure; friable.

B_2 — 9–11″ brown (10YR5/3) clay loam; subangular block structure; friable.

C — Very pale brown moderately stony till.

PROFILE 3 — Otonabee — Location, Ops Township, Con. IX, Lot 8.

A_1 — 0–4″ very dark brown (10YR2/2) loam; crumb structur friable.

B_1 — 4–10″ brown (10YR5/3) loam; subangular structure; friabl

B_2 — 10–14″ brown (10YR5/3) clay loam; subangular bloc structure; friable.

C — Very pale brown calcareous till.

PROFILE 4 — Waupoos — Location, Mariposa Township, Con. VI, Lot 15.

A_1 — 0–3″ very dark grey (10YR3/1) clay loam; subangular bloc structure; friable; stonefree.

A_2 — 3–8″ grey-brown (10YR5/2) clay loam; subangular bloc structure; friable; stonefree.

B_2 — 8–16″ reddish brown (5YR4/3) clay; angular bloc structure; firm; stones in lower part of horizon.

D — Grey-brown calcareous stony till.

PROFILE 5 — Waupoos — Location, Mariposa Township, Con. V, Lot. 10.

A_1 — 0–3″ very dark grey (10YR3/1) clay loam; subangular blo structure; friable; stonefree.

A_2 — 3–6″ grey-brown (10YR5/2) clay loam; subangular blo structure; friable; stonefree.

B_2 — 6–14″ reddish brown (10YR5/2) clay; angular blo structure; firm; stones in bottom part of horizon.

D — Grey calcareous stony till.

APPENDIX TABLE No. 2

ANALYSES OF SURFACE SAMPLES FROM VICTORIA COUNTY

		Sand 1.0-.05mm.	Silt .05-.002mm.	Clay .002mm.	pH	O.M.
	Otonabee					
nple No.	1	43	37	20	7.5	3.6
nple No.	2	44	38	18	7.6	2.2
nple No.	3	54	28	18	7.6	3.8
nple No.	10	48	34	18	7.4	3.6
nple No.	11	44	39	17	7.3	6.7
	Average	46	35	18		3.9
	Dummer					
nple No.	25	38	40	22	7.4	5.9
nple No.	26	36	44	20	6.9	6.2
nple No.	27	54	28	18	7.1	4.7
	Average	42	37	20		5.6*
	Waupoos					
nple No.	17	36	38	26	7.6	4.7
nple No.	18	34	34	32	7.5	5.6
nple No.	19	31	43	26	7.4	7.2
nple No.	29	34	36	30	7.5	4.0
	Average	33	37	28		5.3
	Solmesville					
nple No.	6	19	45	36	6.7	6.5
nple No.	9	18	42	40	7.0	6.0
nple No.	14	18	44	38	7.0	5.4
	Average	18	43	38		5.9
	Smithfield					
nple No.	28	18	46	36	7.3	5.8
nple No.	30	22	37	41	7.6	5.8
	Average	20	41	38		5.8
	Simcoe					
nple No.	8	22	48	30	7.5	4.9
nple No.	13	14	46	40	6.8	5.4
	Average	18	47	35		5.1
	Brighton					
nple No.	12	65	25	10	6.7	3.4
nple No.	20	72	21	7	6.5	2.6
nple No.	21	61	29	10	6.1	2.2
	Average	66	31	9		2.7
	Wendigo					
nple No.	4	86	4	10	5.7	2.9
nple No.	22	72	21	7	5.7	3.6
nple No.	24	71	24	5	5.6	3.4
	Average	76	16	7		3.3
	Dundonald					
nple No.	5	54	36	10	7.1	3.8

*No — All surface samples were collected from cultivated fields with the exception of the Dummer samples which were taken from permanent pasture.

Bridge
Dam
Ferry
W. L. 241

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L SURVEY OF MANITOULIN ISLAND

REPORT No. 26 OF THE ONTARIO SOIL SURVEY

Prepared jointly by the Research Branch, Canada Department of Agriculture and the Ontario Agricultural College

NADA DEPARTMENT OF AGRICULTURE, OTTAWA
TARIO DEPARTMENT OF AGRICULTURE, TORONTO

SOIL SURVEY
of
MANITOULIN ISLAND
Ontario

by

D. W. Hoffman
R. E. Wicklund
Research Branch, Canada Department of Agriculture

and

N. R. Richards
Ontario Agricultural College

GUELPH, ONTARIO
December, 1959

REPORT No. 26 OF THE ONTARIO SOIL SURVEY

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no. 2

SOIL SURVEY MAPS AND REPORTS PUBLISHED BY COUNTIES

Norfolk ..... Map No. 1
Elgin ..... Map No. 2
Kent ..... Map No. 3
Haldimand ..... Map No. 4
Welland ..... Map No. 5
Middlesex ..... Map No. 6
Carleton ..... Report No. 7
Parts of Northwestern Ontario ..... Report No. 8
Durham ..... Report No. 9
Prince Edward ..... Report No. 10
Essex ..... Report No. 11
Grenville ..... Report No. 12
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Perth ..... Report No. 15
Grey ..... Report No. 16
Bruce ..... Report No. 17
Peel ..... Report No. 18
York ..... Report No. 19
Dufferin ..... Report No. 20
New Liskeard — Englehart Area ..... Report No. 21
Lambton ..... Report No. 22
Ontario ..... Report No. 23
Glengarry ..... Report No. 24
Victoria ..... Report No. 25

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Drafting of the soil map and analyses of the various soils were carried out at the Agricultural College and grateful acknowledgment is made of the help provided by the staff.

The soil map was prepared for lithographing by the Cartographic section of the Soils Research Institute, Central Experimental Farm, Ottawa.

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Map—Soil Map of Manitoulin Island in pocket back of report.

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1. Outline Map of Ontario Showing Location of Manitoulin Island
2. Outline Map Showing Townships and Principal Centres
3. Outline Map Showing Bedrock Geology
4. Outline Map Showing Distribution of Soil Materials

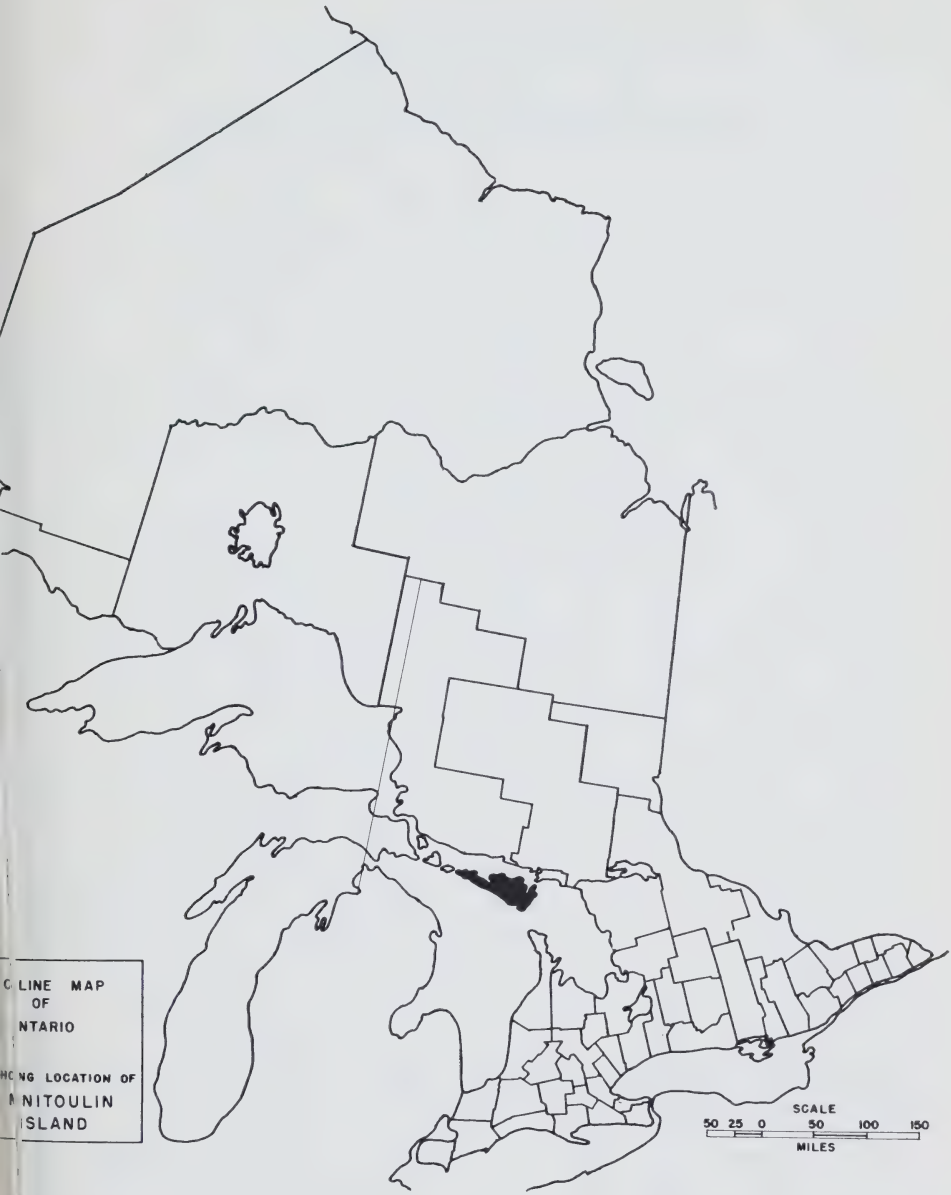


FIGURE 1: Outline Map of Ontario Showing Location of Manitoulin Island.

Soil Survey Report of Manitoulin Island, Ontario

by

D. W. Hoffman,[1] R. E. Wicklund,[2] *and* N. R. Richards[3]

INTRODUCTION

A survey of the soils of Manitoulin Island was begun in the summer of 195 with the object of obtaining information about the soils occurring in this are The soil map that was prepared showing the extent and distribution of th various types of soils found, accompanies this report.

The variations in soils occurring in this area, are not as great as those foun in many other counties in Ontario. The relief is low, and flat lying limestor bedrock is at or very near the surface over a large part of the island. The soi that can be used for cultivation are those occurring on lake-laid clays, sandy ou wash and till plains and many of the shallow soils are used as grazing land f livestock. The agricultural potential of this area in terms of soil use is limite However increases in the production of cereal grains, hay, and pasture can l expected with improved methods of soil management.

This report deals with the characteristics of the soils as to their formatio nature, capabilities and suitability for agricultural use. Each soil type is describ in detail and its location can be identified on the soil map.

A section on soil management and a rating of the soils according to the suitability for various crops is included in the report. Much of this informati is general, and is an attempt to present the principles of good soil manageme as they apply to all soils. Sources of additional information with regard to cro and fertilizer practices are listed for the interested reader.

1 Pedologist, Canada Department of Agriculture
2 Senior Pedologist, Canada Department of Agriculture
3 Head, Department of Soils, Ontario Agricultural College

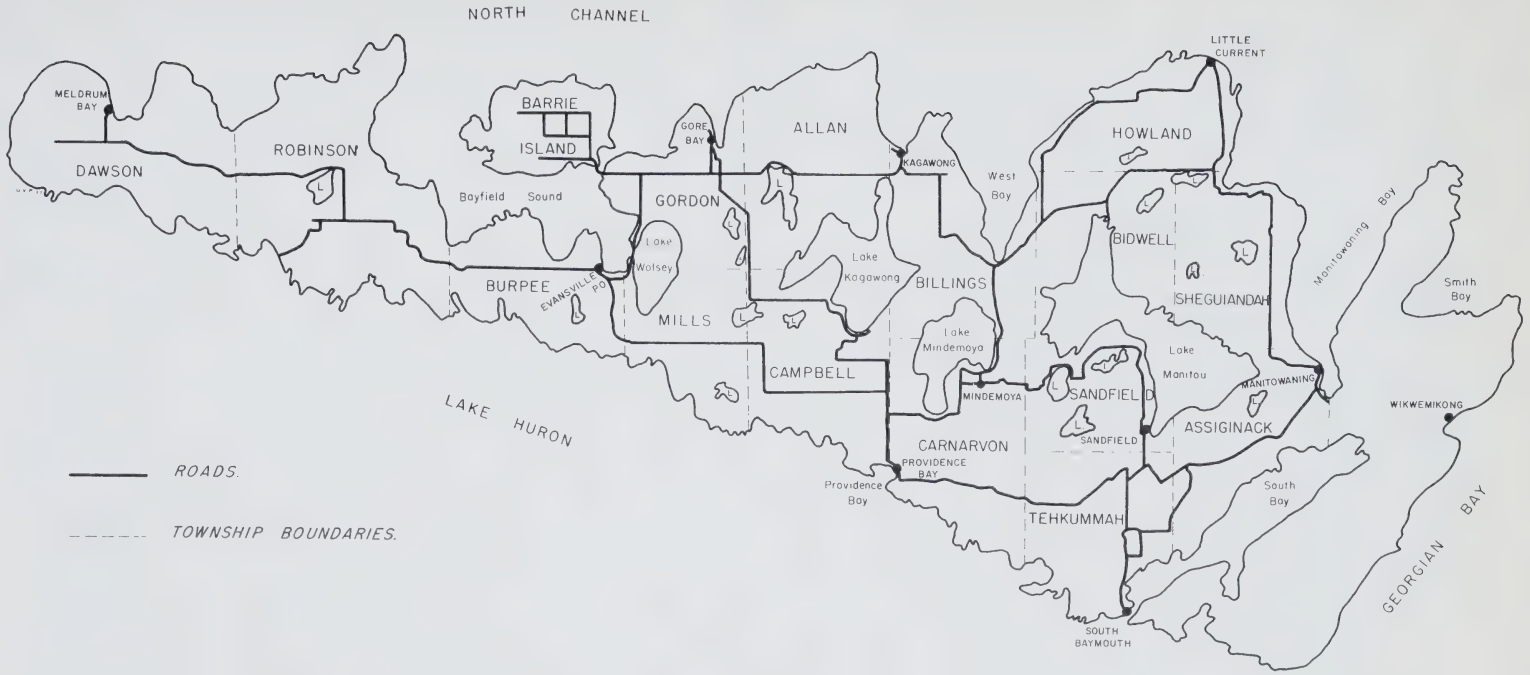


FIGURE 2: Outline Map Showing Townships, Principal Centres, etc.

GENERAL DESCRIPTION OF THE AREA

Location

Manitoulin Island is located in the northern part of Lake Huron approx mately at 45° latitude and 82° longitude. It is said to be the largest "freshwate island in the world.

The total land area is about 712,000 acres (1,100 square miles) of whic 290,000 acres or about 40 per cent is occupied farm land.

Principal Towns

There are two incorporated towns on the Island each having less tha 2,000 inhabitants. Gore Bay (770) is the shopping and administrative centre f the western end of the Island. The office of the Agricultural Representative located here and nearby is a large Canadian Government airport. Little Curre (1,614) is the gateway to the mainland, the only railway contact and chief po

The small unincorporated centres of South Baymouth, Sheguianda Mindemoya, Kagawong, Spring Bay, Silverwater and Meldrum Bay, provi shopping facilities and tourist accommodation.

Population and Racial Origin

According to the 1951 Census the total population of the Island was 11,21 Approximately 90 per cent (9,817) of the people were rural dwellers but on 46 per cent lived on farms.

The trend in population from 1871 to 1951 is shown in Table 1.

TABLE 1
TREND IN TOTAL POPULATION

Year	Population	Year	Population
1871	2,231	1921	10,468
1881	8,460	1931	10,734
1891	10,794	1941	10,841
1901	11,828	1951	11,214
1911	11,324		

TABLE 2
POPULATION BY PRINCIPAL ORIGINS, 1951 CENSUS

Canadians of British Origin	7,690	68.6%
Native Indians	2,450	21.9%
Canadians of French Origin	515	4.6%
Canadians of Other Origins	559	4.9%
Total Population	11,214	100.0%

Transportation

Manitoulin Island is fairly well supplied with roads but transportati facilities from the Island to the mainland are poor. Roads traverse the Isla connecting the population centres. Many of the main roads are oil surfaced b the township roads are few in number and often rough. A rough, twisting ro from Little Current to Espanola is the only connecting road from the Island the mainland. Running more or less parallel to this road is a spur line of t Canadian Pacific Railway which ends at Little Current.

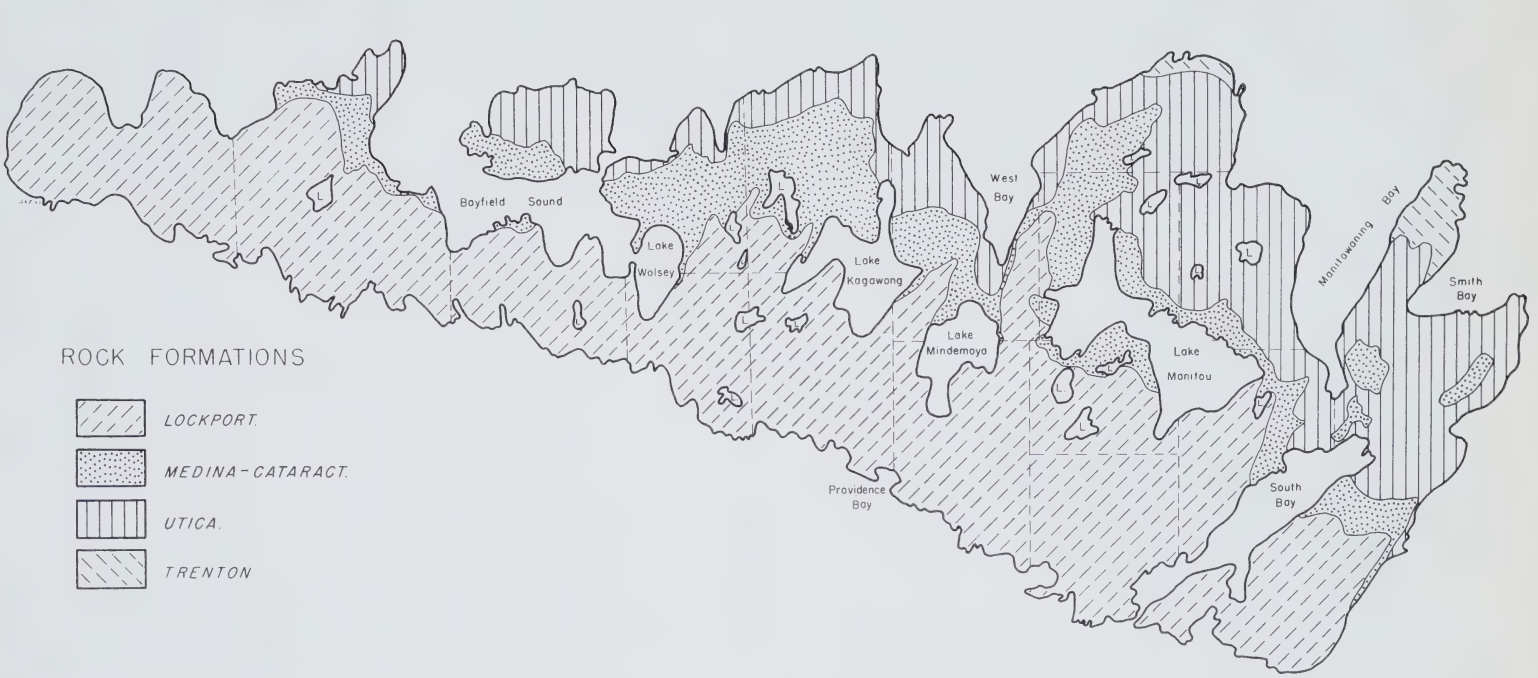


FIGURE 3: Outline Map Showing Bedrock Geology.

Geology of the Underlying Rocks

Manitoulin Island is underlain by rocks of Ordovician and Silurian ages which outcrop in many places. Limestones of the Trenton, Medina-Cataract and Lockport formations and shales of the Utica and Meaford formations are present.

The Trenton formation is seen only on the northeast part of the Island near Little Current and again on the long peninsula farther east that terminates in Bold Point. This limestone is of the magnesian variety and contains on the average 6 per cent of silica, iron and alumina.

The dolomite of the Medina-Cataract formation is also siliceous and argillaceous containing on the average about 7 per cent of impurities. This dolomite is dark brown to dark bluish grey in colour with seams of blue shale occurring in some localities. It is hard and contains silicified fossils and small nodules of white chert.

The Lockport dolomite which composes the major part of the Island, is over 300 feet thick. West of Campbell Bay this dolomite is brown and has a high silica content with numerous silicified fossils. A very pure cream to buff coloured porous dolomite is more common east of Campbell Bay. Some of the purest limestone on the Island occurs at South Baymouth.

The shales of the Utica and Meaford formations are grey to dark bluish grey in colour and contain layers of calcareous sandstone and sandy shale.

TABLE 3

ANALYSES OF THE UNDERLYING LIMESTONE FORMATIONS
MANITOULIN ISLAND

	1 Trenton Formation	2 Medina Formation	3 Lockport Formation
Silica ($Si O_2$)	4.16	6.50	1.22
Ferric Oxide ($Fe_2 O_3$)	0.80	0.54	0.14
Alumina ($Al_2 O_3$)	1.46	1.84	0.32
Calcium Phosphate ($Ca_3(PO_4)_2$)	0.09	0.11	0.02
Calcium Carbonate ($Ca CO_3$)	82.41	50.16	53.54
Magnesium Carbonate ($Mg CO_3$)	10.54	40.95	43.96
Total	99.46	100.10	99.20

Samples for analyses from:
(1) Little Current (2) Gore Bay (3) Evansville

A ridge of white quartzite of Precambrian age protrudes through the Palaeozoic strata appearing in the neighbourhood of Sheguiandah.

The distribution of the different bedrock formations is shown in Figure 3.

Suface Deposits

The surface deposits in the Manitoulin area are chiefly of glacial origin and they form the parent material from which the soils have developed. The variations that occur in texture, relief and drainage of soils are a result of differences in the nature of these deposits.

The principal types of surface deposits are described in Table 4 and their distribution is shown in Figure 4.

A large part of the Island consists of scoured rock plains, that are flat, and covered with only a few inches of soil. In some places the drift deposits by the

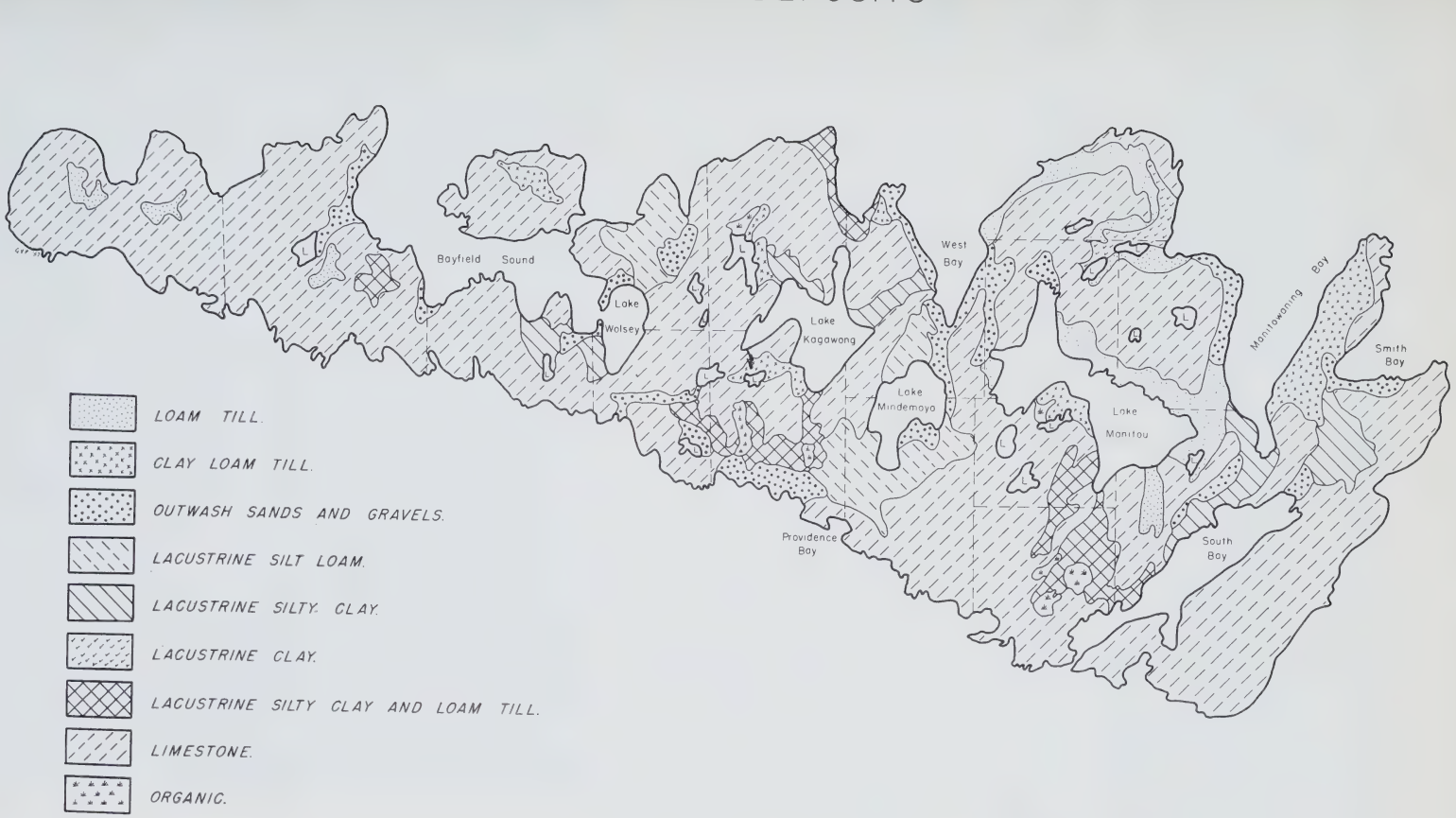


FIGURE 4: Outline Map Showing Distribution of Surface Deposits.

melting ice of the Wisconsin glaciation, is deeper and till plains, drumlins, moraines, outwash plains and lake-laid silts and clays occur.

The glacial till materials occur near Lake Manitou, Manitowaning Bay and the eastern part of the north shore and also as underlying deposits below the lacustrine and outwash materials of the various basins and depressional areas. This till is generally coarse textured and consists of a mixture of boulders, cobbles, gravel, sand, silt and clay. These materials have formed loam to clay loam soils with various degrees of stoniness and a topography which varies from regular moderately sloping to irregular, hilly.

Ground moraine, which is by far the most extensive form in which these till deposits occur in this area, is characterized by knolls and numerous sloughs. The terminal moraine on the other hand is usually rough consisting of hills that were formed at the terminus of the glacier when it melted. An area of terminal moraine occurs a few miles south of Little Current.

Another form of till deposit is the elongated hill or drumlin. Manitoulin Island has about 175 drumlins. They were all submerged in Lake Algonquin and as a result of wave action large numbers of boulders remain on their crowns and sides.

Outwash deposits are represented by coarse material sorted from glacial till by rapidly-flowing glacial streams.

During the process of sorting the fast-flowing water removed most of the silt and clay and left a residue of sand, gravel, cobbles and boulders. These coarse textured materials were laid down in running water in patterns which are recognized as outwash plains, beaches and kames. The outwash plains occur as gravelly or sandy areas having gently sloping topography. Gravel bars are common on the Island having been produced by various receding levels of Lake Algonquin.

TABLE 4

SURFACE DEPOSITS OCCURRING IN THE MANITOULIN MAP AREA

Deposit	Description
1. GLACIAL TILL:	
Ground Moraine	Generally unsorted material. Topography is characterized by a succession of low knolls and depressions. Textures are loam to clay loam — contains stones and boulders.
Terminal Moraine	Often modified or resorted. Topography is rough to hilly. Textures range from sandy loam to clay loam — stonier than ground moraine.
Drumlin	Elongated hill lined in the direction of ice advance, usually unsorted. Textures loam to clay loam. Contains stones and boulders.
2. GLACIO-FLUVIAL:	
Outwash Plain	Sandy and gravelly area occurring on a nearly level plain but may be marked by enclosed depressions and by incised ravines. Often cobbly but is usually boulder-free.
Kame	Short hill of sand and gravel — may contain resorted till. Contains some stones and boulders.
3. LACUSTRINE	Clays, silts and sands laid down in glacial lakes. Topography usually very gently sloping, although moderately steep slopes are encountered in some areas. Stones are few to absent except in areas where thin lacustral deposits are underlain with till.
4. RECENT ALLUVIAL	Post-Glacial deposits of sands, silts and clays along streams, meadows, sloughs and marshes. Also includes mucks and peats. Soils are immature; topography is nearly level to depressional. Stones are rare.

The kame deposits, consisting of gravel, occur in the form of short hills. In general these hills of gravel are associated with till deposits occurring also in a rough topography.

The lacustrine deposits occupy the lower flatter areas which represented the bed of glacial Lake Algonquin. Most of the glacial lake deposits have regular, gently sloping topography although some dissection by streams has caused unevenness of the terrain. The texture of the lacustrine deposits varies from silt loam to clay. Most of these deposits are free of stone, particularly where they are thick. Where more than an occasional boulder is encountered the lacustrine deposit is usually thin and the underlying till is close to the surface. Some stones and boulders may have been rafted into these lakes by ice.

Deposits of organic materials occur throughout the Island. They are the partly decayed remains of trees, shrubs and mosses and have been classified as muck.

Vegetation

The type of natural vegetation found in an area is determined by climatic and soil factors. When vegetation becomes established it in turn exerts considerable influence on the development of a soil and therefore is an important factor in soil formation. The extent to which vegetation influences soil development varies with the type of vegetation.

Since vegetation is one of several inter-related soil forming factors, it is very difficult to measure the exact effect that it has had on the profile features which are used to make soil type separations. A survey of the vegetation shows, in a general way, what tree associations most commonly occur on some of the more

A typical woodlot on Manitoulin Island.

TABLE 5

TEMPERATURE AT GORE BAY, PROVIDENCE BAY AND OTHER SELECTED POINTS

Month	Temperature in Degrees F.				
	Gore Bay (22)*	Providence Bay (26)	Kapuskasing (19)	Huntsville (30)	Brantford (51)
December	21	22	6	19	26
January	14	16	−2	14	22
February	13	15	2	12	20
Winter	16	18	2	15	23
March	24	25	14	24	31
April	35	37	31	39	43
May	50	48	36	52	55
Spring	36	37	30	38	43
June	60	57	57	61	65
July	66	64	62	66	70
August	64	63	60	64	67
Summer	63	61	60	64	67
September	57	57	51	57	61
October	46	46	39	45	48
November	33	33	22	32	37
Fall	45	45	37	45	49
Annual	40	40	32	41	45
May 1 to Oct. 1	59	58	55	60	64

*Years Observed.

important soils. This information is given in the discussion of each soil series i the next chapter of this report.

The most commonly occurring trees are sugar maple, red maple, elm, bas wood, yellow birch, red and white oak, ironwood, beech, white and black as

aspen, and white birch. Conifers are scattered generally but in no great quantity and consist of white and red pine, white spruce, balsam, fir, and hemlock.

Climate

There are two meteorological stations on Manitoulin Island located at Gore Bay and Providence Bay. Climatic data is presented in Tables 5 and 6 from these stations and other selected points. Data from Kapuskasing are included to represent the northern coniferous region and that from Huntsville represents the transitional zone between hardwoods and conifers. Records from Brantford are included to represent the hardwood region in Southern Ontario.

According to Table 5 the winters in the surveyed area are cold with a mean temperature of 16° to 18°F and the summers are warm with a mean temperature of 61° to 64°F. Temperature differences between the regions listed are greater in winter than in summer. For instance the difference between Gore Bay and Brantford is 7 degrees in February and 4 degrees in July. In May the mean temperature at Gore Bay has risen above 42 degrees which is sometimes used as a value to mark the beginning of crop growth.

The extreme high records are 97 degrees and 100 degrees. The lowest temperature on record is minus 41 degrees, giving an extreme range of 141 degrees which is rather wide for a region surrounded by water.

The frost free period averages 125 to 129 days from about May 26 to the end of September, however, frosts have been recorded in all months. The growing season opens April 24 to 26 and closes October 21 to 25; the average length being 178 to 186 days.

Precipitation includes both rain and snow with the latter recalculated to its rainfall equivalent in inches of a ratio of ten to one. The average annual precipitation at Providence Bay is 31.57 inches, one third of which falls during the growing season.

There is a winter maximum and summer minimum in precipitation. The light rainfall in March and April is favourable as it allows the land to dry up so that it may be cultivated. However the precipitation for the summer months is also low resulting in a high drought frequency. As a result pastures become dry, grasses wither, and the carrying capacity of the natural pasture is considerably reduced.

Snowfall ranges from 83 to 118 inches. The climate of Manitoulin Island is in brief one of moderately cold, snowy winters with late springs, dry and sunny summers and open falls.

Relief

In general, Manitoulin Island varies in altitude from 600 to 800 feet above sea level with some hills above 1000 feet. Along the south shore of the Island the rocky floor dips gradually under the water but perpendicular cliffs are common near the north shore. For the most part the relief of the Island is level to undulating.

Drainage

Manitoulin Island contains more than one hundred lakes, the three largest, Kagawong, Mindemoya, and Manitou, together cover more than 65 square miles. Rivers draining the area are generally shallow and small. The largest are Blue Jay Creek, Manitou Creek and Mindemoya River. These flow in a southerly direction and empty into Lake Huron.

TABLE 6

PRECIPITATION AT GORE BAY, PROVIDENCE BAY AND OTHER SELECTED POINTS

Month	Precipitation in Inches				
	Gore Bay (22)*	Providence Bay (26)	Kapuskasing (19)	Huntsville (30)	Brantford (51)
December	2.97	3.22	1.90	3.28	2.24
January	2.45	4.27	2.00	3.09	2.61
February	1.98	3.01	1.06	2.45	2.12
Winter	7.40	10.50	4.96	8.82	6.97
March	2.32	2.59	1.56	2.78	2.16
April	2.19	1.97	1.82	2.09	2.54
May	2.12	1.86	2.12	2.85	2.90
Spring	6.63	6.42	5.50	7.74	7.60
June	2.25	2.43	2.33	3.69	2.65
July	1.90	1.95	3.43	2.96	3.05
August	2.03	1.91	2.94	2.70	2.93
Summer	5.78	6.29	8.70	9.35	8.63
September	2.81	2.59	3.54	3.84	2.63
October	2.98	3.00	2.50	3.44	2.47
November	3.09	2.72	2.39	3.24	2.40
Fall	8.88	8.31	8.43	10.52	7.50
Annual	29.09	31.52	27.59	36.41	30.70
May 1 to Oct. 1	11.11	10.74	14.36	16.04	14.16

*Years observed.

THE CLASSIFICATION AND DESCRIPTION OF THE SOILS

The surface geological deposits previously described are the parent materials from which the soils have developed. This development has taken several forms as a result of differences in the parent materials as well as the effects produced by differences in drainage and in vegetation.

Under the cool humid conditions present in this region, and with forest vegetation, the processes of soil development tend toward acid conditions. This acid condition is the result of the removal of bases, particularly calcium, from the surface layers of the soil by percolating water. This is referred to as a process of leaching and the effect produced on the soil is in the development of layers or horizons that differ from one another in thickness, colour, texture and structure.

A cut made through the horizons exposes what is known as the soil profile. In agricultural practice it is often customary to refer to the different combinations of horizons as surface soil, subsurface soil, subsoil and parent material. However because many soils have more than four horizons it is convenient to use the specific pedological terms A horizon, B horizon and C horizon which are further designated as A_0, A_1, A_2, B_1, B_2, C, etc. for more detailed and accurate descriptions where the main soil horizons are subdivided.

The A horizon is the horizon where maximum weathering takes place and from which the downward movement of water removes the bases. In many soils the A horizon can be subdivided into A_1 and A_2. The A_1 horizon contains the largest amounts of organic matter and the A_2 is the horizon of greatest leaching or eluviation. Some of the materials leached from the A_2 accumulate in the B horizon. The B horizon is often finer in texture and more compact as a result of the accumulation of clay and other fine materials carried down from the A horizon. Underlying the B horizon is the C horizon which may be unaltered or only slightly altered by the soil forming processes. The geological deposits on which the soil is developed are known as parent material.

Poorly drained soils in which ground water stands in the soil profile have a condition designated as "Gley". The gley or G horizon is a layer in which intermittent water logging causes partial oxidation and reduction of iron and is recognized by bluish grey, brownish grey as well as mottled colours and the presence of iron concretions.

Soils are classified on the basis of the development of the horizons which make up the soil profile.

Eighty-one different soils were recognized and mapped on the Island. These soils differ from one another in one or more of the following features of the soil profile — number, colour, thickness, texture, structure and chemical composition of the horizons, or in drainage, depth to bedrock and stoniness.

Because many soil series have certain features in common they are grouped into Great Soil Groups. Those occurring on Manitoulin Island are Alluvial, Brown Forest, Grey-Brown Podzolic, Grey Wooded, Brown Podzolic, Podzol, Dark Grey Gleisolic, Shallow Organic and Organic. A generalized description of some of these groups follows.

Soils of the Brown Forest Great Soil Group exhibit shallow profiles and a brownish colour in the subsoil.

The Brown Forest soils occur chiefly on highly calcareous till materials These soils have a dark brown surface horizon high in organic matter with a neutral or mildly alkaline reaction. The A_1 horizon is about 4 inches in thickness and is underlain by a brown coloured B horizon which may contain slight accumulation of sesquioxides and some clay. In general the B horizon shows no colour subdivisions and the brown colour carries down to the parent material at a depth of about 18 inches. The base saturation of all horizons is taken to be 100 per cent.

The Grey Wooded soils occur on lacustrine sediments or fine textured till deposits, both of which are calcareous. These soils have a bleached grey surface horizon and a darker coloured subsurface horizon containing accumulations of clay, sesquioxides, and organic materials. In a virgin state the soil profile consists of a thin A_0 horizon underlain by a light brownish grey or white A

This profile exhibits the characteristics of the Grey Wooded Great Soil Group. The A_1 horizon is very thin.

orizon, that is very low in organic matter and is slightly to moderately acid in eaction. The B horizon is dark brown in colour, contains more clay and sesquixides than the horizons above and some form of blocky structure. The greying rom the A_2 horizon carries down over the upper part of the B to form a pronounced AB horizon. As a consequence the profile exhibits an overall greyish olour. Depths of profiles are usually 20 to 26 inches.

The Grey-Brown Podzolic soils in this area occur only on coarse textured eposits. Under normal conditions they differ from the Grey Wooded on the asis of colour and also on the development of the surface horizons. The profile ossesses a dark greyish brown A_1 horizon, 3 inches thick and relatively high organic matter, which is underlain by a yellowish brown A_2 horizon that comes lighter in colour with depth. The B horizon is brown in colour and is

A Grey-Brown Podzolic Soil Profile.

finer in texture than other horizons in the profile. It contains accumulations clay. The calcareous parent material occurs at depths of 20 to 30 inches.

The Podzol soils have an A_0 horizon 1 to 2 inches thick which is underla by a grey or white A_2 horizon varying from 1 to 2 inches in thickness. The horizon is reddish brown and contains accumulations of sesquioxides and organ matter or both and is usually divisible into two subhorizons B_{21} and B_{22}.

A large part of the deep soils on Manitoulin Island have developed und poorly drained conditions. The poorly drained soils of the Island are rep sentative of the Dark Grey Gleisolic and Organic Great Soil Groups.

The Dark Grey Gleisolic soils have a mineral surface soil high in orgar matter and a dull coloured subsoil with yellow and orange mottling. In t profile a very dark grey A_1 horizon generally 7 to 8 inches thick occurs. This underlain by a mottled dark grey to greyish brown "gley" horizon which re on the parent material.

Soils of the Podzol Great Soil Group exhibit an ashy grey A_2 horizon.

The Organic Soils consist of an organic accumulation on the surface more han 12 inches thick. This is underlain by a strongly gleyed mineral soil or rock. he surface layer may differ depending on the type of vegetation from which ıe organic accumulation has been formed and on the degree of decomposition the organic materials. The Shallow Organic soils are similar to the Organic ils except that the organic accumulation is less than 12 inches thick.

ries, Types and Phases

Soils are classified and placed in categories such as series, types and phases. ıe principal mapping unit is the series which in turn may consist of two or ore types or phases. The features that characterize the series are determined m the profile and all the soils included in a series are relatively uniform both their development and in their land use. The soil type, a subdivision of the

Note profile characteristics of a Dark Grey Gleisolic soil — Surface soil is a dark grey colour subsoil a drab grey with reddish brown mottling.

soil series, is based on the texture of the surface soil. The full name of the soi type is a combination of the series name and the surface texture, for example Little Current clay. The soil phase is not a part of the natural classification o soils and can be a subdivision of the soil type, series or any other classificatio unit. Phases are usually subdivisions of soil types and are based on externa characteristics of the soil. These separations are introduced to show difference in slope, degree of erosion or content of surface stone.

The soils of Manitoulin Island have been classified and grouped on th basis of differences in parent material and drainage as presented in the ke below.

SOIL KEY

A. Soils Developed on Glacial Till	Acreage	% of Total
I. Stony, calcareous, sandy loam parent material		
(a) Good Drainage		
1. Dumfries loam (G.B.P.)	1,200	0.2

	Acreage	% of Total
(b) Imperfect Drainage		
1. Killean loam (G.B.P.)	100	—
(c) Poor Drainage		
1. Lily loam (D.G.G.)	100	—
II. Calcareous, loam parent material		
(a) Good Drainage		
1. Vasey loam (B.P.)	12,800	1.8
2. Vasey loam — shallow phase (B.P.)	1,000	0.2
(b) Imperfect Drainage		
1. Howland loam (B.P.)	5,900	0.8
2. Howland loam — shallow phase (B.P.)	2,100	0.3
3. Howland sandy loam (B.P.)	100	—
(c) Poor Drainage		
1. Lyons loam (D.G.G.)	3,500	0.5
2. Lyons loam — shallow phase (D.G.G.)	2,300	0.3
III. Calcareous, clay loam parent material		
(a) Good Drainage		
1. Buzwah clay loam (G.W.)	22,400	3.1
2. Buzwah silty clay loam (G.W.)	2,100	0.3
3. Buzwah clay loam — shallow phase (G.W.)	2,200	0.3
4. Buzwah silty clay loam — stony phase (G.W.)	8,500	1.3
(b) Imperfect Drainage		
1. Leech clay loam (G.W.)	7,800	0.7
2. Leech silty clay loam (G.W.)	1,000	0.2
3. Leech clay loam — shallow phase (G.W.)	2,600	0.4
4. Leech silty clay loam — shallow phase (G.W.)	2,400	0.3
5. Leech silty clay loam — stony phase (G.W.)	700	0.1
(c) Poor Drainage		
1. Phipps clay loam (D.G.G.)	2,700	0.4
2. Phipps silty clay loam (D.G.G.)	700	0.1
3. Phipps clay loam — shallow phase (D.G.G.)	500	0.1
4. Phipps silty clay loam — stony phase (D.G.G.)	300	—

3. Soils Developed on Outwash

I. Stone and gravel parent material		
(a) Good Drainage		
1. Donnybrook sandy loam (G.B.P.)	3,100	0.5
II. Medium and fine sand parent material		
(a) Good Drainage		
1. Bridgman sand (R)	1,700	0.2
2. Wendigo sandy loam (P)	21,400	3.0
3. Wendigo sand (P)	800	0.1
4. Wendigo fine sandy loam (P)	1,400	0.2
(b) Imperfect Drainage		
1. Mallard sandy loam (P)	3,200	0.5
2. Mallard sandy loam — stony phase (P)	100	—
3. Mallard sandy loam — shallow phase (P)	200	—
(c) Poor Drainage		
1. Kenabeek sandy loam (D.G.G.)	7,500	1.2
(d) Very Poor Drainage		
1. Burpee muck (S.O.)	1,000	0.3
III. Loam and sandy loam deposits underlain by gravel		
(a) Good Drainage		
1. Burford loam (G.B.P.)	13,200	1.9
2. Burford loam — shallow phase (G.B.P.)	300	—
3. Burford sandy loam (G.B.P.)	500	0.1
(b) Imperfect Drainage		
1. Brisbane loam (G.B.P.)	600	0.1
(c) Poor Drainage		
1. Gilford loam (D.G.G.)	1,600	0.2
2. Gilford sandy loam (D.G.G.)	300	—

	Acreage	% of Total
C. Soils Developed on Sands Underlain by Silty Clay		
(a) Good Drainage		
1. Bucke fine sandy loam (P)	1,200	0.2
2. Bucke sandy loam (P)	900	0.1
(b) Imperfect Drainage		
1. Otterskin sandy loam (P)	2,200	0.3
2. Otterskin fine sandy loam (P)	1,000	0.2
(c) Poor Drainage		
1. Englehart fine sandy loam (D.G.G.)	2,000	0.3
2. Englehart sandy loam (D.G.G.)	800	0.1
D. Soils Developed on Lacustrine Deposits		
I. Non-Calcareous Silt Loam Underlain by Silty Clay		
(a) Good Drainage		
1. Thwaites silt loam (P)	3,100	0.4
(b) Imperfect Drainage		
1. Casey silt loam (P)	1,000	0.2
II. Calcareous silt loam parent material		
(a) Good Drainage		
1. Evanturel silt loam (G.W.)	6,500	0.9
2. Evanturel silt loam — stony phase (G.W.)	100	—
3. Evanturel silt loam — shallow phase (G.W.)	100	—
(b) Imperfect Drainage		
1. Earlton silt loam (G.W.)	10,600	1.5
2. Earlton silt loam — stony phase (G.W.)	500	0.1
3. Earlton silt loam — shallow phase (G.W.)	500	0.1
(c) Poor Drainage		
1. Cane silt loam (D.G.G.)	4,500	0.6
2. Cane silt loam — stony phase (D.G.G.)	100	—
3. Cane silt loam — shallow phase (D.G.G.)	100	—
III. Calcareous silty clay parent material		
(a) Good Drainage		
1. Campbell silty clay loam (G.W.)	4,300	0.6
2. Campbell silty clay loam — stony phase (G.W.)	500	0.1
3. Campbell silty clay loam — shallow phase (G.W.)	200	—
4. Campbell silty clay loam — shallow, stony phase (G.W.)	500	0.1
(b) Imperfect Drainage		
1. Gordon silty clay loam (G.W.)	21,400	3.0
2. Gordon silty clay loam — stony phase (G.W.)	1,500	0.2
3. Gordon silty clay loam — shallow phase (G.W.)	2,600	0.4
4. Gordon silty clay loam — shallow, stony phase (G.W.)	1,900	0.3
(c) Poor Drainage		
1. Wolsey silty clay loam (D.G.G.)	9,500	1.3
2. Wolsey silty clay loam — stony phase (D.G.G.)	600	0.1
3. Wolsey silty clay loam — shallow phase (D.G.G.)	400	—
4. Wolsey silty clay loam — shallow, stony phase (D.G.G.)	1,000	0.2
IV. Calcareous clay parent material		
(a) Good Drainage		
1. Pike clay (G.W.)	1,000	0.2
2. Pike clay — stony phase (G.W.)	800	0.1
(b) Imperfect Drainage		
1. Bass clay (G.W.)	500	0.1
2. Bass clay — stony phase (G.W.)	600	0.1
(c) Poor Drainage		
1. Perch clay (D.G.G.)	500	0.1
2. Perch clay — stony phase (D.G.G.)	1,000	0.2

	Acreage	% of Total
E. Shallow Soils		
I. Calcareous loam and silt loam material underlain by limestone		
(a) Good Drainage		
1. Farmington loam (B.F.)	429,200	60.3
2. Kagawong silt loam (B.F.)	5,600	0.8
II. Calcareous clay underlain by calcareous shale		
(a) Good Drainage		
1. Little Current clay (B.F.)	1,700	0.3
F. Organic Soils		
(a) Very Poor Drainage		
1. Muck (O)	22,700	3.0
G. Miscellaneous Soils		
1. Marsh (A)	1,300	0.2
2. Rock-Wendigo complex	9,200	1.3
3. Rock	400	—

GREAT SOIL GROUPS

A — Alluvial
B.F. — Brown Forest
O. — Organic
B.P. — Brown Podzolic
D.G.G. — Dark Grey Gleisolic
G.B.P. — Grey-Brown Podzolic
G.W. — Grey Wooded
P. — Podzol
S.O. — Shallow Organic
R — Regosol

A. Soils Developed on Glacial Till

DUMFRIES SERIES

These soils occupy a continuous block of land 1,200 acres in size on the astern end of Manitoulin Island a few miles south of the town of Little Current. hey are developed on stony soil material which has been derived mainly from mestone rocks. The material is therefore calcareous, and free carbonates can e found at depths of 18 to 24 inches.

The topography is more rugged than is characteristic of other soils on the sland. Slopes are steep, irregular and generally short. All of the Dumfries soils re well drained but associated imperfectly and poorly drained areas are to be ound in the depressions. These depressions often occur as "potholes" and contain ater during a large part of the year. They cannot be easily drained and therefore e not arable. The soils are stony and possess both granite and limestone boulders the surface and throughout the soil mass.

Stones in the Dumfries profile usually interfere with cultivation.

Because of the steep slopes Dumfries soils are very susceptible to erosion and should be kept under a cover of trees or grass for as long as possible. The natural vegetation in woodlots consists of sugar maple, silver birch, beech, poplar and basswood.

A typical profile of a Dumfries soil possesses a dark grey A_1 layer, 3 to 4 inches thick. This A_1 layer is stony, neutral in reaction and has a granular structure. The A_2 is yellowish brown and becomes lighter in colour with depth. The B horizon is dark brown and contains more clay than the soil above or below it. The parent material that occurs at depths of 18 to 24 inches is a light grey calcareous, stony sandy loam. This is a Grey-Brown Podzolic soil.

The Dumfries soils have been cleared and cultivation has been attempted in some areas. In the main these soils are too stony and too steep for cultivation but can be used as pasture land. The existing pasture lands are often weedy and growth of grasses is sparse in many areas. These pastures could be improved economically by spraying to get rid of the weeds. The native grasses would then be able to increase in number and vigour. Care should be taken to prevent the overgrazing of pasture lands. As soon as the pasture shows signs of being overgrazed the livestock should be removed and no further grazing be permitted until the grass has had a chance to recover. The grass should be permitted to make a reasonable amount of growth before winter sets in.

KILLEAN SERIES

The Killean soils occur in association with the Dumfries and occupy about 00 acres. The topography is irregular, gently sloping and the drainage is imerfect. The slopes are gentle and there is little danger of erosion. The land is overed with tree vegetation which consists mainly of sugar maple and soft maple.

The profile of Killean loam, the only soil type mapped, is similar to that f the Dumfries loam except that the horizons are not as well defined and the A_2 and B horizons are usually mottled. Mottling is the result of slow drainage.

Killean loam is neutral to slightly acid and contains more stones and boulders han are usually found in the Killean soils mapped in Southern Ontario.

The small areas of this soil that occur on the island must be considered as on-agricultural.

LILY SERIES

The Lily soils are unimportant soils on Manitoulin Island both from the andpoint of acreage occupied and their uses for agricultural purposes. They cupy a total mappable area of about 100 acres and are to be found associated th the Dumfries soil. Although the Lily soils are developed on materials similar those of the Dumfries they are poorly drained and the topography is depresonal. They are very stony and possess both granite and limestone boulders at e surface and throughout the soil profile.

A typical soil profile possesses a very dark greyish brown A_1 horizon about inches thick. This horizon is very stony and is alkaline in reaction. The G rizon is greyish brown, stony and very mottled and is more alkaline than the horizon. The parent material that occurs at depths of 20 to 24 inches is a careous, very stony sandy loam.

The large number of stones and boulders on the soil surface and poor drainage exclude the use of these soils for cultivated crops. However they could be used for growing certain tree species. Present wooded areas are made up mainly of elm and white cedar.

VASEY SERIES

The Vasey soils are stony and have developed from a till that has been derived from Precambrian granites and limestones of a more recent age. These soils occupy a total area of 13,800 acres or 2.0 per cent of the surveyed area. The largest areas of Vasey soils are to be found in the eastern and western ends of the Island. These soils occur in other parts of the Province particularly in northern Simcoe County.

The topography of the Vasey soils is somewhat more rugged than is characteristic of some of the other soils on the Island. In general slopes are moderate over most of the land but steeper slopes are found where it is drumlinized. All of these soils are well drained but associated imperfectly and poorly drained soils are to be found in the depressions.

Soil development shows some of the characteristics of both the Brown Podzolic Great Soil Group and of the Grey-Brown Podzolic soils. The upper part of the soil profile is characteristic of the former but a fairly well developed textural B horizon is always present at a depth of about 30 inches. The soil profile possesses a dark greyish brown A_1 horizon which rests on a dark brown B horizon. The B horizon becomes lighter in colour with depth and is underlain by a very pale brown horizon which is considered to be the remaining portion of the A_2 of the original Grey-Brown Podzolic soil. It rests on a yellowish brown B horizon. This B horizon contains more clay than the layers above or below it.

Most of the Vasey soils on Manitoulin Island are non-arable because of the large number of stones and boulders on the soil surface. However they are used to a considerable extent for grazing purposes and in some instances, where the stones have been removed, are used to grow spring grains and hay.

These would appear to be ideal soils for forest lands. The sugar maple is the dominant species and is associated with a great variety of other trees such as silver birch, basswood, poplar, beech and spruce. The use of the stony Vasey soils as permanent forest sites should be encouraged.

HOWLAND SERIES

The Howland soils are found in association with the Vasey soils and have developed on the same kind of materials. The topography is very gently sloping and the drainage is imperfect. Most of the land is covered by trees and maple elm, silver birch, poplar, spruce and hemlock are the chief species.

Howland loam (5,900 acres), Howland loam — shallow phase (2,100 acres) and Howland sandy loam (100 acres) are included in the series and make up 1.1 per cent of the surveyed area. The profile is similar to that of the Vasey soil except that the horizons are not as well developed and reddish mottles occur in the parent materials, the B horizons and the A_2. Stones are numerous both on the surface and throughout the soil mass.

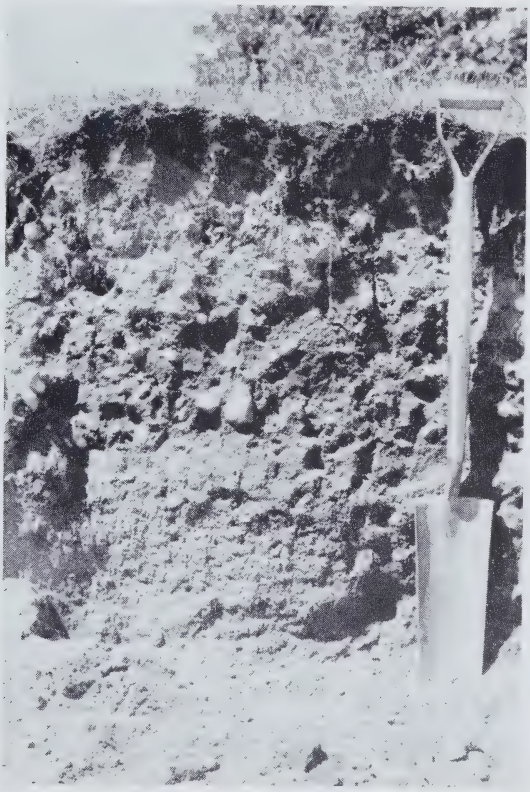
The soils of the Howland series that occur on the Island are non-arable. However they are used for grazing purposes although they are stony and, for the most part, covered with trees. Because of the stony nature of these soils it is doubtful that any program of pasture improvement would be economical. These would appear to be suited to the growing of trees and the use of Howland soils for forest sites should be encouraged.

LYONS SERIES

The Lyons soils occupy 5,800 acres or almost one per cent of the whole area and are usually found in association with the Vasey and Howland soils. The topography is level. Although the surface soil is strewn with stones and boulders of dominantly igneous origin, some of the stones are derived from adjacent formations of limestone and calcareous shale.

The soil drainage is poor as a result of slow run-off. Most of the land is covered with trees and black spruce, alder, poplar, cedar, hemlock and elm are the most common species.

Lyons loam (3,500 acres) has the characteristics of the Dark Grey Gleisolic Great Soil Group and consists of a very dark grey to black A_1 horizon about six inches thick followed by a mottled drab grey G horizon. The G horizon has a massive structure and is alkaline in reaction and rests on stony calcareous sandy loam till.



A profile of Buzwah clay loam.

Where the soil is between one foot and three feet deep over limestone bedrock it has been mapped as Lyons loam – shallow phase. Twenty-three hundred acres of this soil have been mapped on the Island.

Because of excessive stoniness and poor drainage the Lyons soils on Manitoulin Island should be considered as non-agricultural.

BUZWAH SERIES

The Buzwah soils are important because they are deep and can be used in some areas for the growing of crops. These soils range from very to moderately stony. The Buzwah soils are developed from a till that has been derived from dolomitic limestone and reddish calcareous shale.

Soils included in the Buzwah series are the clay loam (22,400 acres), silty clay loam (2,100 acres), clay loam – shallow phase (2,200 acres) and silty clay loam – stony phase (8,500 acres). They occupy a total area of 35,200 acres or 5 per cent of the Island. The largest area of the Buzwah soils is to be found west of Wikwemikong but other areas of considerable size occur near Lake Manitou, Lake Kagawong, Ice Lake and on Barrie Island.

The topography of the Buzwah soils is smooth, moderately sloping except where they occur near the shores of Manitowaning Bay. Here there is a relatively

Landscape showing the undulating surface of the Buzwah soils.

sharp drop to the water's edge and slopes are steep. All of these soils are well drained but small areas of imperfectly and poorly drained soils are to be found in the depressions.

The soil profile has a dark greyish brown A_1 horizon about 2 inches thick. This layer has a granular structure and is slightly acid in reaction. The A_2 horizon is yellowish brown and becomes lighter in colour with depth. This horizon is also acid to a depth of approximately 16 inches. At this depth a well developed dark brown B horizon is present that contains more clay than the soil above or below it. This horizon has a nuciform structure and is neutral in reaction.

The parent material that occurs at depths of 20 to 24 inches is a pinkish grey, calcareous, stony, clay loam till and a pale brown, stony loam till which may be layered or mixed. This kind of soil development may be considered to be a weak form of Grey Wooded.

Most of the Buzwah soils are non-arable because of stoniness. These soils are used for grazing purposes and although they are stony they serve some useful purposes as grazing land. These would appear to be ideal soils for the growth of forest tree species. Sugar maple and silver birch are the dominant species and are associated with a great variety of other trees such as beech, poplar, basswood, elm, spruce and hemlock.

Less stony areas of these soils occur on Barrie Island and near Ice Lake and are used for the growing of hay, alfalfa, clovers, oats and barley. Yields of timothy and clover hay average 1½ to 2 tons per acre and barley and oats average 30 to 40 bushels to the acre. Usually the crops grown are fed to beef cattle thus providing manure which is used to good advantage on the land.

LEECH SERIES

The soils of the Leech series are moderately fine textured Grey Wooded soils that have developed on the same calcareous till as the Buzwah soils. They occupy 1,500 acres or 1.7 per cent of the total land area and occur in association with the Buzwah soils. The topography is smooth gently sloping and there is little or no danger of erosion because water run-off is slow. The tree cover on the virgin soils consists mainly of poplar, elm, cedar, silver birch and hemlock. These soils are imperfectly drained but small areas of Phipps soils are found in the depressions.

Soil types included in the Leech series are clay loam and silty clay loam. In some areas, particularly on the eastern side of Lake Kagawong, the soil materials are only 1 to 3 feet deep over the limestone bedrock and a shallow phase of these soils has been mapped. Surface stones are sometimes numerous in the silty clay loam and in such very stony locations a stony phase was mapped.

The soil profile is like that of the Buzwah soils but is not as well developed. Red and yellowish mottles occur in the B horizon and parent material of the soils giving evidence of imperfect drainage.

The less stony fields and fields where the stones have been removed are suited to most of the crops grown in the area. Clovers, timothy, oats, and barley produce good yields. Legume, grass crops should be used in rotation with coarse grains to provide feed for livestock and a source of manure. Fertilizers should be used

to improve soil fertility. Much of this land is non-arable due to stoniness and is used for woodlots or pastures.

PHIPPS SERIES

The Phipps soils often occur in small areas scattered throughout the Island but some larger areas are located at the bases of the many limestone bluffs occurring in the area. They occupy a total area of 4,200 acres and are some of the less important soils on the Island.

The topography is depressional although where the soils occur near the limestone ridges the land is gently sloping. The drainage is poor due to the very slow run-off or the seepage from adjacent higher land. Most of the soils are forested, cedar and poplar being the dominant species present.

The Phipps series consists of the clay loam and silty clay loam types. Clay loam — shallow phase and silty clay loam — stony phase are also mapped.

A typical soil profile possesses a black A_1 horizon about six inches thick. This horizon has a nuciform structure and is neutral in reaction. The G horizon is grey and contains many yellow and reddish mottles. The parent material that occurs at about 20 inches is the same as that of the Buzwah.

The Phipps soils are non-arable due to stoniness and poor drainage and are used for trees or rough pasture.

B. Soils Developed on Outwash Materials

DONNYBROOK SERIES

The Donnybrook soils are developed on calcareous, gravelly outwash containing a large number of stones and boulders. They occupy a total area of 4,300 acres and may occur on long narrow ridges known as eskers, on beaches or on kames. These soils occur under similar situations in other parts of the Province particularly in Huron and Bruce Counties.

The topography of the Donnybrook soils is rugged and consists of irregular steep slopes. Moisture percolates easily through the coarse materials and runs rapidly off the steep slopes. All of these soils are therefore well drained. The dominant trees found on areas of these soils that are still forested are sugar maple and beech. Red pine occur on the sandier locations.

The soil profile is characteristic of the Grey-Brown Podzolic soils and possesses a dark greyish brown A_1 horizon about 4 inches thick. The A_2 horizon is yellowish brown and becomes lighter in colour with depth. This horizon is 8 to 12 inches thick, slightly acid in reaction and has a weak platy structure. A dark brown B horizon that contains more clay than the soil above or below occurs below the subsurface layer. The parent material occurs at about 18 inches and is a very pale brown gravelly, calcareous outwash. These materials are non-uniform, and small pockets of sand or calcareous loam till may be present.

The Donnybrook soils that occur on Manitoulin Island are non-arable soils. However they are used for grazing purposes and although the topography is rough and they have a low moisture holding capacity they provide roughage for livestock for a part of the growing season. Because of the stony nature of these soils and the rugged topography any program of pasture improvement would be difficult.

These soils would appear to be ideal sites for the growth of some forest tree species and their use for this purpose should be encouraged.

BRIDGMAN SERIES

The Bridgman soil occurs on a ridge in the vicinity of Providence Bay where it occupies a total area of 1,700 acres. This soil occurs in areas of drifting sand where the dark surface soil has been entirely removed by wind and water erosion. Areas mapped as Bridgman sand include eroded areas and areas where materials have accumulated.

The soil profile shows little or no development. The surface layer is either eroded away or buried by the moving sand. The remainder of the profile consists of loose, coarse and medium sand with some gravel and boulders, which grades in colour from yellow to very pale brown from the surface to the parent materials.

Bridgman sand should be considered as a non-agricultural soil. In its present condition the sand carried from the eroded areas by the wind accumulates on cropland, pastureland, and woodland. All "blow-outs" should be reforested and fenced from livestock.

A Wendigo sandy loam profile.

WENDIGO SERIES

The soils of the Wendigo series occupy 23,600 acres or slightly over 3 per cent of the total land area and are often found near a body of water. They are formed from very pale brown, water-worked, stratified medium to fine sands.

The soils have a smooth gently sloping topography and are well drained. A large percentage of the precipitation, seeps rapidly through the soil, due to the porous nature of the materials. The original vegetation probably consisted mostly of red pine however, much of the pine has been cut and remaining woodlots are made up of silver birch, basswood, and poplar with some maple, spruce and fir. Most of the land which at one time was cleared and cultivated has subsequently been abandoned and it is now covered with grasses, weeds and some trees.

Three soil types of the Wendigo series are mapped on Manitoulin Island, namely Wendigo sandy loam, Wendigo sand and Wendigo fine sandy loam.

In undisturbed locations the profile has a very dark grey strongly acid A_1 horizon about 1 inch thick made up of decomposed needles, leaves and twigs. The A_2 horizon is white, strongly acid and about 2 inches thick. The B horizon is yellowish brown and becomes lighter in colour with depth. The parent material that occurs at depths of 24 to 30 inches is non-calcareous sand. Soils with this kind of development are classified as Podzols.

The cultivated surface soil of the Wendigo soils is generally brownish grey in colour, very loose and contains very little organic matter and plant nutrients. Areas mapped as Wendigo fine sandy loam are sometimes underlain by calcareous very fine sand or silt loam at depths of five to six feet.

Only a small percentage of the Wendigo soils is under cultivation. Most of the land is in pasture or trees. However, an area near Gore Bay is being cultivated and fair yields of oats and hay are obtained when the soil is carefully managed. In general hay and grain yields are low due to the low fertility, low moisture holding capacity and the acid nature of the soils.

In the management of the Wendigo soils for crop production the state of the organic matter content must be given major consideration. The organic matter content should be increased and maintained by heavy applications of barnyard manure. The organic matter not only adds nitrogen, but also increases the moisture holding capacity of the soil. Lime is required for most crops, particularly clovers. The amount to add is best determined by a soil test. Complete commercial fertilizers are required for the production of most crops. The rate of application and the type of mixture used varies greatly with the crops grown and the amount of manure used.

When there is sufficient moisture and the soils are heavily fertilized certain special crops such as potatoes and raspberries may be grown. However it is unlikely that the Wendigo soils will be intensively cultivated due to the high cost of fertilizer and the danger of crop failures because of lack of moisture.

MALLARD SERIES

The Mallard soils occupy a total area of 3,500 acres on Manitoulin Island and are not of any great importance as agricultural soils. Their materials consis

of non-calcareous outwash sand that has been derived from Precambrian granites. These soils occur in small blocks in association with the Wendigo soils.

The topography of the Mallard soils is similar to that of other imperfectly drained soils on the Island. Slopes are smooth and gentle. Percolation of water through the soil is slow because of the presence of underlying rock or clay and run-off is slow due to the gentle slopes. Therefore the soil is imperfectly drained. The trees found in existing woodlots are mainly spruce and hemlock with some silver birch and pine.

The sandy materials from which the Mallard soils have developed have been deposited over clay or bedrock to various depths. The thickness of the sand varies from 2 to 10 feet and where the sand is less than 3 feet deep over bedrock the soil has been mapped as Mallard sandy loam—shallow phase. Mallard sandy loam—stony phase is mapped where cobbles and boulders appear on the soil surface.

The profile consists of a black organic A_0 horizon underlain by a well developed, white, strongly acid A_2 horizon. This rests on a reddish brown to brown B horizon which sometimes contains an "ortstein" formation. The "ortstein" formation is likely formed by the cementation of the sand particles by iron and organic compounds. The parent material that occurs at depths of 18 to 24 inches is a non-calcareous sand.

Since the Mallard soils are strongly acid, low in fertility and imperfectly drained they should be considered non-agricultural. Most of the land was once cleared and cultivated but many of the fields have been abandoned and are now covered with small trees and scrub growth. Although a few acres are used for rough pasture the soil should be allowed to return to forest.

KENABEEK SERIES

The soils of the Kenabeek series have formed from sandy materials and occur in association with the Wendigo soils. They occupy depressions in the landscape and therefore the drainage is poor. The tree vegetation consists mainly of spruce, cedar, tamarack and some willow.

The Kenabeek soils occupy 7,500 acres on Manitoulin Island and have the characteristics of the Dark Grey Gleisolic Great Soil Group. A typical soil profile possesses a very dark brown A_1 horizon 5 to 6 inches thick. This horizon has a crumb structure and is strongly acid in reaction. The G horizon is grey, very mottled and becomes less acid with depth. The parent material occurs at a depth of approximately 18 inches and is similar to that of the Wendigo soils.

Kenabeek soils are non-arable because of poor drainage, acidity and low fertility and are best used as woodlots.

BURPEE SERIES

The Burpee soils occur near the southern shore of the Island west of Providence Bay and occupy a total area of 1,000 acres. They are formed on sandy materials similar to those from which the Wendigo soils have developed. The land surface is depressional and consequently water accumulates on the surface resulting in a very poorly drained soil. Most of the Burpee soils are

covered by trees with white spruce, white cedar, silver birch and a few white pine most commonly occurring.

The external appearance of the Burpee soil is somewhat similar to the Kenabeek but it has a much higher organic matter content and less mottling. The profile consists of a well decomposed, organic, neutral to slightly acid surface layer less than 12 inches deep but with an average depth of 8 inches. The C

Burpee muck — The organic surface is about 8 inches deep.

horizon is drab greyish brown slightly mottled and neutral in reaction. The parent material is non-calcareous sand.

The Burpee soil is non-agricultural because of very poor drainage and is used for growing trees.

BURFORD SERIES

The Burford soils occupy a total area of 14,000 acres or 2.0 per cent of the Island. The largest of these areas are to be found along the south shore of Smith Bay, near the east shore of West Bay and along the west shore of Manitowaning Bay. Smaller blocks occur in other parts of the Island.

The topography is smooth, gently sloping except in some places where steeper ridges have been formed by wave action. All of these soils are well drained but small areas of other imperfectly and poorly drained soils are to be found in the depressions. Most of the land is forested and sugar maple, silver birch, poplar and spruce are the chief species found as well as a variety of other trees such as pine, oak, ironwood and basswood.

A Burford loam profile. Note the wavy B horizon.

The Burford series has been classified into two types; loam and sandy loam. Two hundred acres of the Burford loam is underlain by bedrock at depths of less than three feet and these areas are mapped as Burford loam — shallow phase.

Although the soil profile is Grey-Brown Podzolic it is not as well developed as that of the Burford soils found in more southerly parts of the Province. It consists of a thin, medium acid, dark greyish brown A_1 horizon underlain by a yellowish brown A_2 horizon which becomes lighter in colour with depth. This is followed by a dark brown, slightly acid to neutral B horizon which contains

more clay than the soil above or below it. The B horizon is wavy and as a result the depth of the solum varies considerably. This profile rests on calcareous, pale brown stratified gravel and has no unaltered parent material. Stones and gravel occur in varying amounts throughout the profile.

Although the Burford soils are fairly well suited to the growing of general farm crops and certain specialized crops a large part of the land remains under tree cover. In some locations the lack of cultivation of the land is likely due to the presence of large numbers of stones and boulders strewn about the surface of the soil.

Where the land is cultivated, yields of grasses and clovers are good. Alfalfa produces well due to the abundance of lime and the good drainage of the soils. However, these soils are low in fertility and have a low moisture reserve and the best yields are obtained only in seasons of adequate rainfall and when the soils receive sufficient amounts of commercial fertilizers.

BRISBANE SERIES

The Brisbane soils occupy a total area of only 600 acres on the Island and are therefore of minor importance agriculturally. They are situated on the very gentle slopes that occur in the depressions of the Burford soils. The drainage is imperfect because of seepage of water from the surrounding higher land. The loam is the only soil type in the Brisbane series mapped on the Island.

The soil profile possesses a dark coloured A_1 horizon which is often thicker and contains more organic matter than the A_1 horizon of the Burford soils. This horizon has a granular structure and is slightly acid in reaction. The A_2 horizon is mottled, yellowish brown and is more acid than the A_1. A brown, mottled B horizon occurs at a depth of about 12 inches which contains more clay than the soil above or below it but is less well developed than the similar horizon in the Burford soils. This profile rests on stratified gravel similar to that on which the Burford profile rests. However, as with the Burford, this gravel material is not the same material from which the profile developed.

This kind of soil development may be considered to be a weak form of Grey-Brown Podzolic or, on the other hand, a transitional form from Grey-Brown Podzolic to Dark Grey Gleisolic.

Most of the land is forested and tree species such as poplar, balsam and spruce are most commonly found. Cleared areas are used for rough pasture. The Brisbane soils on Manitoulin Island have not been cultivated because of slow drainage and stoniness.

GILFORD SERIES

The soils of the Gilford series occupy a total area of 1,900 acres and usually occur in small blocks that are found in the depressional areas among the Burford soils. They are poorly drained because water accumulates in the depressions and remains for a large part of the year. The soils are stony and both granite and limestone boulders occur at the surface and throughout the soil mass. Most of the Gilford soils are wooded and tree species such as elm, soft maple, poplar, spruce and willow most commonly occur.

Gilford loam (1,600) and Gilford sandy loam (300) are the types in the Gilford series mapped on the Island.

A typical soil profile has a black A_1 horizon 6 to 8 inches thick. This horizon has a granular structure and is slightly alkaline in reaction. The G horizon is greyish brown, very mottled and has a blocky structure. This rests on calcareous, stratified gravel.

The Gilford soils that occur on the Island are non-arable and are used for trees and rough pasture. Because of the poor drainage and the stony nature of these soils it is doubtful that any program of land improvement would be practical. These soils are best used for forestry.

C. Soils Developed on Sands Underlain by Silty Clay

BUCKE SERIES

The Bucke soils occur in small blocks in the vicinity of Gore Bay and Mindemoya and have been mapped in other parts of Northern Ontario, particularly in the southeastern part of the Temiskaming District. They occupy a total area of 2,100 acres or 0.3 per cent of the area of the Island. These soils have developed from non-calcareous sand that has been deposited to a depth of less than 3 feet over calcareous silty clay.

The topography of the Bucke soils is not as rugged as many of the other well drained soils on the Island. In general, slopes are smooth and gentle except for an area south of Gore Bay where they are more rolling. Water percolates rapidly through the sandy materials until it reaches the less permeable silty clay. At this point it runs over these finer materials and into the drainage waters. Much of the land has been cleared but where trees remain silver birch, pine, sugar maple and beech are the main species found.

Except for the presence of silty clay at depths of 3 feet and less and the absence of sand parent material the Bucke profile resembles that of the Wendigo. Sandy loam and fine sandy loam soil types are mapped on the Island. A typical virgin soil profile has a thin very dark grey A_0 horizon which is composed of leaf litter and roots. The A_2 horizon is light grey and is strongly acid in reaction. This horizon is about 2 inches thick and rests on a yellowish brown B horizon that becomes lighter in colour with depth. The B horizon is underlain by varved, calcareous silty clay that is unlike the material from which the profile developed.

In some locations, where the soil surface has been disturbed, a thin, dark grey mineral layer is found below the organic surface layer, and where the soil has been cultivated the surface and subsurface have been more or less intermixed with the upper portion of the subsoil resulting in a greyish brown surface layer about six inches thick.

The Bucke soils are dry, strongly acid and of low fertility. Where they are cultivated the Bucke soils are used for general farming and sometimes for gardening. Although the natural fertility is low it can be improved considerably. The ability of the soil to retain moisture and plant nutrients can be increased by plowing down buckwheat or clover. Growers report yields obtained with the use of some manure but without commercial fertilizer, on the Bucke sandy loam, average 1 to 1½ tons per acre for hay, 20 to 30 bushels per acre for oats and 150-200 bushels per acre for potatoes. Yields on the Bucke fine sandy loam are some-

what higher because of its higher natural fertility. Increased yields can be expected when commercial fertilizer is used. The analysis and rate of fertilizer to be used depends upon the crop to be grown and the soil test. Lime is necessary for the normal growth of clover, especially alfalfa.

OTTERSKIN SERIES

The Otterskin soils are imperfectly drained, occur in association with the Bucke soils and occupy 3,200 acres of the total land area of Manitoulin Island. They are stonefree soils and consist of medium or fine sands deposited over silty clay at depths of 3 feet or less.

The topography is smooth, very gently sloping which is characteristic of many of the imperfectly drained soils on the Island. Because of the very gentle slopes water run-off is low. Water percolation is rapid through the sandy materials in the upper part of the soil but is slowed down considerably when it reaches the underlying clay. The trees found in existing woodlots consist mainly of poplar, spruce and pine. Both sandy loam and fine sandy loam soil types have been mapped.

Englehart fine sandy loam. The deep dark coloured surface soil is typical of poorly drained soil

These are acid, leached soils having a Podzol type of soil development. A virgin profile possesses a very dark grey A_0 horizon 2 inches thick. This horizon is composed of raw humus and roots and is strongly acid in reaction. The A_2 horizon is light grey and is often more acid than the layer above or below it. The B horizon is yellowish brown and becomes lighter in colour with depth. Unweathered sand parent materials are absent and the profile rests on varved, calcareous silty clay.

Although the average depth of sand over silty clay is 20 inches there is considerable variation in the depth of the sand and therefore some variability in soil profile. Where the sandy overburden is thin a subsoil horizon is sometimes developed from the silty clay materials and where the sandy overburden is close to 3 feet deep non-calcareous sandy parent material may occur over the silty clay.

Most of the Otterskin soils are cleared and cultivated and are used for general farming. Hay, pasture and oats are the chief crops grown but yields are low because of the poor fertility of these soils. Hay yields range from ¾ to 1 ton, oat yields from 20 to 30 bushels and potatoes yield from 100 to 200 bushels per acre. However, these yields can be increased by the use of manure, fertilizer and lime.

Manure should be added to the soil each year and it can be plowed into the soil during cultivation or applied as a topdressing on hay and pasture crops. The kind and amount of fertilizer to use is best determined by a soil test although in general, crops will respond to applications of fertilizers high in nitrogen and phosphorus. Lime is required by the clovers in the hay and pasture mixtures being grown on these soils and is best applied the year before seeding down.

ENGLEHART SERIES

The soils of the Englehart series occur in small scattered areas throughout the central portion of the Island and occupy a total area of 2,000 acres. They are made up of medium or fine sand which is underlain by silty clay at depths of three feet or less. The Englehart soils occur in the depressions of the associated Bucke and Otterskin soils and since they are found in such depressional areas water accumulates and they are therefore poorly drained. The organic matter content of the surface soil is higher than that in the surface of associated soils found on the better drained sites.

The soil types occurring in the Englehart series are the fine sandy loam and the sandy loam. These soils are classified as Dark Grey Gleisolic and the soil profile possesses a black A_1 horizon about 6 inches thick. This horizon has a crumb structure and a strongly acid reaction. The G horizon is mottled, grey and strongly acid and rests on calcareous, silty clay.

The Englehart soils that occur on the Island are non-arable. However, they are used for natural hay and pasture land and although they are wet they serve some useful purpose as grazing land. Pasture land could be improved by spraying to kill the weeds that interfere with the growth of the native grasses. These soils are suited for the growth of certain tree species, especially spruce, cedar and poplar which are the dominant species found in existing woodlots.

D. Soils Developed on Lacustrine Deposits

THWAITES SERIES

The Thwaites soils consist of non-calcareous silt loam one to three feet deep that is underlain by calcareous silty clay. They occupy a total area of 3,100 acres and occur near the northeastern shore of Lake Kagawong. The topography is smooth, moderately sloping except near the banks of streams. Here the rapidly moving water has washed the soil away and steeper slopes have developed. Although percolation of water through the soil is slow, because of the fineness of the materials, the rolling land provides high run-off and a well drained soil has formed.

The upper part of a virgin Thwaites soil profile is a Podzol and possesses a thin organic A_0 horizon that is very dark grey in colour and strongly acid in reaction. The A_2 horizon is a white, strongly acid layer about 2 inches thick and is underlain by a yellowish brown B horizon. The B horizon becomes lighter in colour to a depth of about 18 inches. At this point a yellowish brown B horizon of a Grey Wooded soil is present that contains more clay than the soil above it. This profile rests on light brownish grey, calcareous silty clay which is similar to the parent materials of the Gordon soils described on one of the following pages of this report. This kind of soil development may be considered as a transition from Grey Wooded to Podzol since the profile consists of a Podzol superimposed on the B horizon of what may be a Grey Wooded soil.

Thwaites silt loam is the only type mapped in the series and is used for general farming. Hay, pasture, oats, and some wheat are grown and yields are fair. The following yields per acre may be considered as averages: hay, 1½ to 2 tons; oats, 30 to 40 bushels; fall wheat, 25 to 35 bushels. Potatoes should be suited to this soil and yields of 300 to 350 bushels can be obtained when adequate amounts of fertilizer are used. Pastures are generally fair but the excess acidity of the soil favours the rapid growth of weeds such as horsetail and sorrel.

The Thwaites soils can be improved by the application of manure and complete fertilizers to improve soil fertility and the use of lime to correct soil acidity. In general, crops respond to applications of nitrogen, phosphorus and potassium.

CASEY SERIES

The Casey soils occupy only a small part of the Island and small blocks, covering a total area of 1,000 acres, occur in the central part of the Island. These soils have developed from non-calcareous silt loam that is underlain by silty clay at an average depth of 24 inches. Slopes are smooth and gentle and therefore water runs off the soil surface slowly. The imperfect drainage of these soils is the result of this low run-off as well as slow percolation of moisture through the fine materials. Most of the Casey soils have been cleared but trees in the remaining woodlots are mainly elm, spruce and maple.

Casey silt loam is the only type mapped and except for the presence of reddish coloured mottles in the subsurface and subsoil and less well developed horizons it is similar in appearance to the Thwaites soil.

This soil is used for general farming and is fairly well suited to growing most of the crops on the Island. The main crops grown are hay, pasture and oats all of which are used to feed the livestock on the farms. Yields are medium to

low but could be improved by additions of manure, commercial fertilizer and lime.

EVANTUREL SERIES

The Evanturel soils consist of a stonefree silt loam that has been derived chiefly from limestones. They occupy a total area of 6,700 acres or approximately 1 per cent of the Island area and are found in the vicinity of Lake Mindemoya

A profile of Evanturel silt loam.

nd the town of Gore Bay. In general these soils have a smooth, moderately loping relief but steep slopes occur in some localities particularly where small treams have dissected the land. All of these soils are well drained but small reas of Earlton and Cane soils are to be found in the depressions.

The silt loam is the only type in the Evanturel series mapped on the Island. Iowever, a shallow phase of the silt loam has been mapped where the depth of oil over bedrock was between one and three feet. Where numerous stones ccurred on the soil surface a stony phase of the silt loam was mapped.

A typical soil profile has a grey A_1 horizon 3 inches thick. This horizon has a granular structure and is medium acid in reaction. The A_2 horizon is pale yellowish brown and becomes lighter in colour with depth. A yellowish brown B horizon occurs below the subsurface at depths of 18 to 24 inches. This horizon contains more clay than the soil above or below it and also becomes lighter with depth.

The parent material that occurs at depths of 30 to 36 inches is a pale brown, calcareous silt loam. The kind of development outlined by the above description may be considered to be a weak form of Grey Wooded or on the other hand a transitional form from Grey Wooded to Podzol especially when, in some virgin locations, a Podzol profile has developed in the subsurface of the Grey Wooded soil. Although the surface layer is thicker and better developed than is common for Grey Wooded soils it is assumed that the highly leached subsurface and the presence of calcareous materials is associated with the development of the Grey Wooded characteristics.

Most of the Evanturel soils on the Island have been cleared and are used to considerable extent for pasture, hay and oats. They are fertile and good yields can be obtained when the soils are well managed. Although the Evanturel soils are productive, manure and phosphatic fertilizer are required to maintain production at a reasonable level. Yields vary from year to year due to differences in weather and management. The yield of oats averages 60 bushels per acre and that of hay is about 2 tons per acre.

Evanturel soils are susceptible to erosion and they should be managed in such a way that excessive soil loss is prevented. It might be wise to keep the steep slopes under a permanent cover of grass or trees.

EARLTON SERIES

The Earlton soils are relatively important soils on the Island because of their wide agricultural uses. Like the Evanturel soils they consist of a silt loam lacustrine material that is calcareous. These soils occupy a total area of 11,600 acres or 1.7 per cent of the Island area. The largest area of these soils is to be found in the vicinity of Lake Mindemoya. However, smaller blocks are found in association with the Evanturel soils. These soils occur under similar situations in other parts of the Province and were first found in the New Liskeard-Englehart area of the Temiskaming District.

The topography is smooth, gently sloping and, as a result, water run-off is slow. The percolation of moisture through the soil is also slow and, therefore, the soil is imperfectly drained. Most of the land has been cleared of trees and is being cultivated. However, species such as sugar maple, elm, spruce, silver birch and alder are found in the woodlots that remain.

Earlton silt loam and stony or shallow phases of this type are mapped on the Island. A typical profile has a dark grey A_1 horizon 3 inches thick. This horizon has a granular structure and is medium acid in reaction. The A_2 horizon is light grey in colour, 4 to 8 inches thick, mottled and is the most acid layer in the soil. This horizon is underlain by a light olive brown B horizon that contains more clay than the soil above or below it. The parent material that occurs at depths of 24 to 30 inches is the same as that of the Evanturel soils.

A profile of Earlton silt loam. The surface is thicker than is common in virgin locations.

This kind of soil development may be considered to be Grey Wooded or, on the other hand, a transition form from Grey Wooded to Dark Grey Gleisolic.

The Earlton soils are among the most fertile in the surveyed area. They are used for dairying, livestock raising, and mixed farming and crops such as hay, pasture, spring grains, and wheat are grown. Hay yields average 2 tons per acre. Good stands of red clover have been observed and alfalfa does well when climatic conditions are good. When adequate amounts of fertilizer and manure are added to the soil the average yield for oats is 75 bushels, for barley is 55 bushels, for field peas is 50 bushels, for fall wheat is 35 bushels and for silage corn is 18 tons per acre. Yields of oats over 100 bushels per acre have been reported. Root crops such as mangels and turnips do well on this soil and are an excellent cattle feed, but due to the amount of hand labour required are not extensively grown.

Additions of manure and commercial fertilizer are necessary to maintain crop production. The use of phosphorus will increase the yields of all crops as will additions of potassium. If hay crops are emphasized the chemical fertilizer should be applied at the time of seeding down, having applied the manure to the hoed crop previously in the rotation. Experiments show that pasture yields can be increased over 50 per cent by adding fertilizer.

CANE SERIES

The Cane soils occur in association with soils of the Evanturel and Earlton series and, on Manitoulin Island, they occupy a total area of 4,700 acres. The percolation of water through the soil is low and excess water runs off very slowly due to the flatness of the land. As a result these soils are poorly drained. Tree species such as spruce, silver birch and alder are found in the woodlots.

Cane silt loam and the stony or shallow phases of this type are mapped on the Island. The soil profile has a very dark grey A_1 horizon 6 inches thick. This A_1 horizon is neutral in reaction and has granular structure. The G horizon is a very mottled pale yellow colour, slightly alkaline in reaction and is underlain by a very mottled light yellowish brown subsoil. The parent material that occurs at depths of 24 to 30 inches is the same as that of the Evanturel and Earlton soils. This is typical of a Dark Grey Gleisolic soil.

The land is not reliable for growing most agricultural crops because of poor drainage and as a result much of the land is used for pasture. In order to prevent water-logging of the soil, ditches or drains with good outlets are needed. Surface drainage can be improved by ploughing the land up in ridges and leaving a dead furrow between the ridges. It is then possible for surface water to run from the ridges into the furrow and down to the drainage outlet.

The Cane soils when drained, will produce good yields of oats, barley and hay but present yields are medium to low. As a matter of fact during wet seasons it is often impossible to sow or harvest a crop. When drainage is improved soil fertility must be maintained by additions of manure and chemical fertilizers.

CAMPBELL SERIES

The Campbell soils are stonefree and consist of a calcareous lacustrine deposit with a silty clay texture. These soils occupy a total area of 5,500 acres and occur in small blocks in the central and western portions of the Island. Slopes are smooth and moderate, much like those of the Evanturel soils. Although the percolation of moisture through the soil is low because of the impermeability of the clay materials, water runs rapidly off the rolling slopes and the soil is well drained. This rapid run-off results in the removal of valuable topsoil, particularly where the soil is cultivated and left without vegetative cover. Most of the land is cleared but some woodlots remain in which elm and sugar maple are the dominant tree species.

Campbell silty clay loam is the only type mapped. A shallow phase of this type has been mapped where the depth of soil over bedrock varies from 12 to 36 inches. A stony phase of the silty clay loam was mapped where numerous stones were present both on the soil surface and throughout the soil mass and where the soil was both shallow and stony a shallow-stony phase was delineated. The soil profile is somewhat similar to that of the Evanturel silt loam but contains a greater amount of clay. The cultivated profile has a dark grey A_1 horizon about 6 inches thick which is underlain by a light grey, medium acid A_2 horizon. The B horizon is brown in colour and contains more clay than the soil above or below it. This B horizon is neutral in reaction and has a blocky structure. The parent material that occurs at depths of 18 to 24 inches is a calcareous light brownish grey silty clay. In undisturbed locations a Podzol development consisting of a

thin organic A_0 horizon, a thin white A_2 horizon and a yellowish brown B horizon occurs in the top 6 inches of the profile described above. These soils are considered to have a form of Grey Wooded development or a transitional form from Grey Wooded to Podzol.

Hay, pasture, oats and mixed grains are the chief crops grown on the Campbell soils. Yields of mixed hay average 1½ to 2 tons per acre and oat yields average 50 bushels per acre. Phosphorus is generally the element most deficient in the Campbell soils but crops also respond to additions of potassium and nitrogen.

Campbell silty clay loam. A weak Podzol profile has developed in the upper 7 inches of this profile.

GORDON SERIES

The Gordon soils are important both from the standpoint of acreage occupied nd their uses for agricultural purposes. They are derived from calcareous, lacstrine clay sediments. They occupy a total area of 27,400 acres or about 4 per ent of the Island area. Areas of these soils are found chiefly in the vicinity of akes Kagawong and Wolsey and occur in association with the Campbell soils.

In some parts of the Island they occupy the gently sloping plains between the long, cigar-shaped till ridges or drumlins.

The Gordon soils are imperfectly drained. Percolation through the soil is slow because of the fineness of the materials. Most of the soils are cleared but small woodlots, in which elm are the dominant species, are found in some districts. Silty clay loam is the only type mapped as well as the stony, shallow and shallow-stony phases of this type.

The cultivated soil profile has a dark grey A_1 horizon about 6 inches thick. This horizon has a nuciform structure and is slightly acid in reaction. The A_2 horizon is mottled, very pale brown and is the most acid layer in the profile. It is underlain by a brown, mottled B horizon that contains more clay than the soil

A profile of Gordon silty clay loam.

above or below it. The parent material that occurs at depths of 15 to 20 inches is the same as that of the Campbell soils. This kind of soil development is considered to be Grey Wooded.

The Gordon soils are among the most fertile in the area and are used for livestock raising and mixed farming. The land is well suited to hay and produce

2 to 2½ tons per acre. Crops such as oats, mixed grains, barley, wheat and fodder corn are grown as well as hay and pasture but the acreages of these crops are relatively small. When adequate amounts of manure are added to the soil the average yield for oats is 55 bushels, for barley is 45 bushels and for winter wheat is 30 bushels.

Although these soils are quite productive they are low in phosphorus and organic matter. Additions of barnyard manure will help to maintain the organic matter content and phosphorus levels can be increased by using chemical fertilizers high in that element.

The stony phase of Gordon silty clay loam is generally too stony to cultivate and is used for rough pasture. The stones could be removed by heavy machinery but this may prove to be uneconomical. The shallow phase tends to be droughty and the growth of roots is restricted for some plants.

WOLSEY SERIES

The Wolsey soils are the poorly drained soils associated with the Campbell and Gordon soils and are derived from the same kind of soil material. They occupy a total area of 11,500 acres or 1.6 per cent of the Island area. The drainage is poor because the percolation of the water through the fine soil materials is slow and excess water runs off very slowly because of the flatness of the land. Water collects and tends to remain at or near the surface for a large part of the year. The tree cover in the woodlots consists mainly of elm, alder and spruce.

Silty clay loam is the only soil type mapped but this type has been subdivided into stony, shallow and shallow-stony phases. The cultivated surface of the soil profile is a very dark grey, moderately friable to hard, slightly acid silty clay loam. This is underlain by a very mottled dark greyish brown G horizon which becomes lighter in colour and more alkaline with depth. The pale greyish brown, calcareous, silty clay parent materials that occur at depths of 15 to 20 inches are the same as those of the Campbell and Gordon soils.

The Wolsey soils are fertile and produce good yields of hay and spring grains, if climatic conditions are favourable. Hay yields of 2½ to 3 tons have been reported. Excess moisture in the spring retards planting and a wet fall prevents harvesting on these flat poorly drained soils. These soils should be worked under optimum moisture conditions for if they are worked when too wet they puddle and bake on drying, which has a poor effect on the growing crop. If the soils are cultivated when too dry they will remain too lumpy for a satisfactory seed bed.

Excess water can be removed by a system of open ditches or by under drainage. The most efficient system is by under drainage. However the cost of installation of a good tile drainage system is high, and monetary returns from the crops grown may not be great enough to make it profitable.

Yields on the Wolsey soils can be increased by additions of phosphatic fertilizers and barnyard manure. The stony phase of Wolsey silty clay loam is too stony for cultivation and is best used for trees or rough pasture.

PIKE SERIES

The Pike soils have developed partly on lacustrine deposits and partly on residual material derived from weathered grey calcareous shale. They occupy a total area of 1,800 acres and are found south of Little Current in the vicinity of Bass and Pike lakes.

The topography is very rugged and slopes are steep. Surface run-off is therefore rapid and much of the surface soil has been eroded.

Pike clay and Pike clay — stony phase are two separations made in this series. The profile horizons are not as well defined in these soils as they are on other well drained soils on the Island. This may be due to the slight percolation of water through the profile and hence a lessening of the movement of minerals, clay, and humus within the profile. However, the soil profile has a light brownish grey A_1 horizon 2 inches thick which is underlain by a light grey A_2 horizon. This subsurface layer has nuciform structure, very plastic consistency and is slightly acid. The B horizon is mottled, yellowish brown and contains more clay than the soil above it. The parent material that occurs at depths of 14 to 18 inches is a calcareous grey clay. This kind of soil development may be considered to be weakly developed Grey Wooded or a transitional form from Regosolic to Grey Wooded.

The gentle slopes of these soil areas are used for pasture and the steep slopes are kept under a cover of trees and grass. Pasture should not be overgrazed or grazed during periods of excess moisture. The use of Pike soils as permanent forest sites should be encouraged.

BASS SERIES

The soils of the Bass series consist of Bass clay and Bass clay — stony phase and they are derived from materials similar to those of the Pike soils. They occupy a total area of 1,100 acres. Since these soils occupy the depressions associated with the Pike soils the drainage is slow and water accumulates readily.

The soil profile is similar to that of the Pike except that it is not as well developed and is mottled. A typical soil profile has a dark grey A_1 horizon 2 inches thick underlain by a pale brown, mottled A_2 horizon. The B horizon is a mottled light yellowish brown colour and contains more clay than the soil above it. The parent materials that occur at depths of 12-15 inches are the same as those of the Pike soils.

Approximately half of the area occupied by Bass clay is under cultivation and is used for general farming. The remainder of the Bass soil is forested and species such as elm and spruce commonly occur. Bass soils are moderately to slightly acid, fertile, but very difficult to handle since they contain more clay than most of the soils in the district. Ploughing and other cultivation practices require much power and can be carried out only when the land has an optimum amount of moisture.

The maintenance of good structure is of prime importance on this soil. Apart from cultivating at proper moisture conditions, the granular structure can be maintained or improved by draining, by liming and by generous addition of organic matter.

Mixed hay, pasture, oats and mixed grains are grown and although no definite data have been obtained on the yields of the different crops the following estimates may be given: mixed hay 1 to 1½ tons per acre; oats 30 to 40 bushels per acre.

PERCH SERIES

The Perch soils are the poorly drained soils associated with the Pike and Bass soils and are derived from the same kind of parent material. This smooth, very gently sloping land occupies a total area of 1,500 acres. Water movement over the surface and through the soil is very slow and, as a result, water accumulates on the surface during periods of high moisture. Elm is dominant in the woodlots and small numbers of spruce and alder also occur.

Perch clay and Perch clay – stony phase are both mapped. The soil profile consists of a very dark grey A_1 horizon 6 inches thick that is sticky when wet and very hard when dry. The G horizon is brownish grey, very mottled, massive layer that becomes greyer with depth. The parent material that occurs at depths of 12-16 inches is calcareous mottled grey clay.

The soil where cultivated, is commonly used for general farming and the principal crops grown are pasture and mixed hay. Yields are dependent on the proper amount of rainfall.

A Perch clay profile.

Drainage problems are serious on the Perch soils since the clay is comparatively impervious and the land is flat. Rounded ploughing or under drainage can be used to get rid of excess water as quickly as possible.

Great care should be taken to keep the cultivated soil in good physical condition. Additions of organic matter will help in maintaining soil structure.

E. Shallow Soils

FARMINGTON SERIES

The Farmington soils are shallow and consist of a till that is derived from limestone and is less than one foot deep. In some areas the underlying limestone bedrock appears at the surface and the till can only be seen in the crevasses of the rock. These soils occupy a total area of 429,200 acres or approximately 60 per cent of the Island.

The topography is level except where it is broken by rocky ledges. These ledges are very steep and form the perpendicular cliffs common in many parts of the Island. The soils are well drained and are droughty during the summer months.

Within the areas mapped as Farmington are small areas of somewhat deeper soils and soils of poorer drainage. The deeper soils rarely exceed a depth of 20 inches and have developed from the same calcareous till as the Farmington soils. They commonly have a weakly developed A_2 horizon between the A_1 and B horizons described for the Farmington soils. These deeper soils and soils of poorer drainage occur to such a small extent that they cannot be separated except on a much more detailed survey. The profile varies. In very shallow soils there is seldom more than a thin organic layer over the bedrock but in the somewhat deeper

Much of the Island consists of flat rock plains covered by a thin layer of soil.

soils the dominant horizon is a brown to dark brown subsoil layer just below the surface soil. The parent material is a calcareous, stony loam. This kind of soil development may be considered to be Brown Forest.

Forestry and grazing are the two chief uses of this soil. Poplar is common where there are a few inches of soil. In the deeper crevasses hard maple grows very well. In the original forest, maple was doubtless the dominant tree species on the shallow limestone plains. Since clearing, and the subsequent loss of organic matter and soil, the areas able to produce maple have been considerably reduced. Reforestation with maple would appear to be highly desirable in many sections.

Large areas are devoted to grazing. This appears to provide the farmer with a living, providing that he has sufficient acreage or can supplement his income from other sources. For crop production this soil must be considered a marginal type. Lack of moisture reduces the efficiency of methods of improving soil fertility which have proven economical on other types. Large investments in fertilizers would not be economical. However, clovers can be grown with fair success in favourable seasons. By growing clovers frequently and using all available farmyard manure and crop residues, a fair state of fertility can be maintained. Liming is not necessary.

The best planned economy for these lands would appear to be the establishment of comparatively large holdings for a single operator which would be largely used for grazing and forestry. The houses of the operators should be fairly well centred in a community so as to provide transportation and social facilities at a minimum of cost. Deeper pockets of soil could be used advantageously to provide for household needs. To a degree this is the present situation in many sections, as many of the farm buildings have been abandoned and the land taken over by neighbours. This has resulted in a very scattered settlement.

KAGAWONG SERIES

The Kagawong silt loam occupies a total of 5,600 acres. This soil is developed on gently undulating to level silt loam materials of less than one foot in depth over limestone bedrock. Most of these materials, although lacustrine in origin, are somewhat stony. The drainage is good to excessive.

Commonly the profile consists of a dark grey surface layer 4 inches thick. This surface layer has a granular structure and is neutral in reaction. The subsoil is yellowish brown, slightly alkaline and has a weak nuciform structure. The pale brown, calcareous parent material only appears where the soil is 8 to 11 inches deep over the bedrock. In a few locations, where the soil approaches 12 inches in depth, a very thin leached subsurface layer occurs. This kind of soil development is Brown Forest or a transitional form from Brown Forest to Grey Wooded. The Kagawong silt loam is used for grazing in much the same way as the Farmington. However, greater content of fine materials gives the Kagawong a higher moisture reserve and level of natural fertility than the Farmington.

LITTLE CURRENT SERIES

Little Current clay occupies a total area of 1,700 acres near the town of Little Current. It consists of less than 12 inches of clay over calcareous, shale bedrock.

The topography is level and the drainage is good. The profile is similar to those of the other shallow soils ranging from a thin organic layer over the rock to a profile having a very dark grey surface soil followed by a very dark greyish brown subsoil layer. This subsoil layer is slightly alkaline and has a massive structure. The soil appears to have weathered directly from the shale bedrock, and is considered to be residual. It has a Brown Forest type of profile development.

The soil is used for grazing. Grazing should not be permitted during periods of excess moisture since plants are punched out and killed by the hoofs of the animals and soil structure is destroyed.

F. Organic Soils

MUCK

Muck soils occupy about 3 per cent or 22,700 acres of the surveyed area. These organic deposits are formed mainly by the decomposition of grasses, sedges and wood debris. The black organic deposit is well decomposed and rests on varved clay, silt loam, sand or bedrock. The muck varies from 18 inches to 10 feet deep but it is generally about 3 feet deep.

Few of the muck soils are cultivated and most of them are covered by tree vegetation composed of spruce, willow and alder. In Manitoulin Island muck soils have not been used to any extent for vegetables because of the long, cold winters. The muck may be used as a source of organic matter for mineral soils.

G. Miscellaneous Soils

MARSH

Areas that are covered by water for a long time and lack a well developed profile are mapped and designated as Marsh. These areas occuping 1,300 acres are covered by water-loving plants such as cattails and sedges and by scrub vegetation, the chief of which is willow. The soil surface may consist of sand, clay or thin muck deposits. These areas are unsuitable for agricultural purposes.

ROCK-WENDIGO COMPLEX (9,200 acres)

Adjacent to the Lake Huron shore of the Island there are areas of limestone bedrock pocketed with small areas of sand. It was found impossible to separate the components of this mixed area on a map of scale 1 inch equals one mile and was mapped as a complex. The dominant components of the complex, are exposures of bedrock and Wendigo sand. Small pockets of Mallard series Kenabeek series and Muck also occur in the complex. These soils have been described previously in this report.

The Rock-Wendigo complex is unsuitable for agricultural purposes and is best used for recreation or forestry.

ROCK (400 acres)

In the Sheguiandah area there appears a ridge of white quartzite of Precambrian age protruding through the Palaeozoic strata. This ridge has little or no covering of soil and has been mapped as Rock.

Grasses and trees, dominantly maple, get their nutrients from the soil and organic material that has accumulated in the cracks and crevasses in the rock. The area mapped as Rock is not suitable for agricultural purposes and should be reforested where possible.

AGRICULTURAL METHODS AND MANAGEMENT

The kinds of crops grown on Manitoulin Island are limited because of the cool climate and the small acreage of deep soils suitable for cultivation. Timothy, clover, alfalfa, oats and mixed grains are the chief crops grown. Small acreages of spring wheat, fall wheat, barley, fall rye, buckwheat, peas, silage corn and potatoes are also grown. The Statistics Branch of the Ontario Department of Agriculture reports the acreage of field crops on Manitoulin Island in 1955 shown in Table 7.

TABLE 7
ACREAGE OF FIELD CROPS IN MANITOULIN ISLAND
(Agricultural Statistics for Ontario 1956)

Hay	38,297
Oats	7,513
Mixed grains	5,990
Winter wheat	791
Corn for fodder	714
Barley	352
Potatoes	324
Spring wheat	98
Buckwheat	89
Corn for husking	84
Peas	45
Field Roots	31
Fall rye	11

The agriculture on the island tends to follow two main patterns. The deeper soils are used for the growing of mixed grains, oats, hay and silage corn, while the stony and shallow soils are used only for grazing. Many farmers own 100 acres in the areas of better soil and keep small herds of breeding stock. In addition they

Hay is one of the chief crops grown on the Island.

have several hundred acres of rangeland on which they pasture their growing animals during the summer. Hereford cattle predominate because of their adaptability to range conditions. The island cattle are in great demand among the farmers of Southern Ontario who purchase them for feeders. Dairying is of minor importance but there are a few good dairy herds which furnish the local milk supply.

The emphasis on grazing is confirmed by the figures for livestock — which are 23,000 cattle — most of them beef breeds — and 14,000 sheep. A noteworthy enterprise on the Island is the raising of turkeys. In 1955 about 25,000 were marketed. Another specialty is fur farming.

Much of Manitoulin remains in forest but most of the good saw-timber has been removed. Spruce and poplar are cut for pulpwood. At one time the fishing industry was very important and in 1931 the catch was more than 3,000,000 pounds. However, in recent years fishing has greatly decreased.

The crops are generally grown in a four-year rotation. The first year of the rotation includes: oats, barley, barley-oats mixture, or potatoes. The second year oats or barley — oats mixture are seeded down with a mixture of red clover, alsike clover, timothy and sometimes alfalfa. Hay is harvested during the two following years and hay aftermaths may be used to supplement the pasture. On farms where there is little or no permanent pasture the rotation may be lengthened to six years and the hay fields used as pastures for the last two years.

All the farm manure is spread on the land. The quantity of manure used varies greatly depending on the number of cattle kept. On farms where large quantities of manure are used annually the soils are rich in humus, have a high fertility level and good physical condition.

Very little commercial fertilizer is used by the farmers because of the cost of transportation. High cost of transportation has also prevented the use of lime on the farms.

Soil Management

The term soil management refers to the various practices that are used or recommended in the use of soils for the growing of agricultural crops. These practices vary with different soils and with different crops and the farmer learns through experience the kind of practices that give the best results. The reason why many different methods are necessary is that soils may be too hilly, too sandy, too dry, too wet or too infertile for good farming. Whatever the limitations of the soil of a particular farm may be the central problem of soil management is to develop and maintain a proper relationship between the plant and the soil in which it grows.

Success in the growing of crops depends therefore on the farmer knowing two sets of factors: the requirements of the different plants he can grow and the characteristics of the soil on his farm. Almost any kind of soil can be modified by management to grow any climatically adapted plant if one is willing to go to the trouble. Most successful farmers try to find satisfying combinations of plants that require a minimum of soil change for good growth.

As mentioned in previous pages most soils consist of a series of definite layers or horizons one above the other, with different colours and other properties

Much of the shallow land is used for grazing.

hese horizons collectively are called the soil profile. Very young soils or those curring in poorly drained positions may not have horizons.

In examining soils the main things to look for are depth, texture, structure, ainage and nutrients.

epth

Since almost 62 per cent of the total land area of Manitoulin Island is made of shallow soils it is important to know the depth of the whole soil, both rface and subsoil, over the limestone bedrock. The depth of the loose soil aterial on the shallow soils of the Island may vary from less than one inch to a pth of one or two feet. Such soils can provide only a small space for roots and e storage of water. During much of the growing season, therefore, these soils nnot supply the plant with the moisture it needs for normal growth. The onths of July and August are the most critical and during this time the grasses se their active growth which, combined with overgrazing, permits weeds and shy plants to become established.

These shallow soils are good grazing lands during the spring and fall asons when rainfall is high, but good management dictates that in order for ass to compete successfully with weeds it should not be overgrazed during the y summer periods.

It is possible that the use of some management practices could improve the ality and quantity of the forage plants growing on these soils. Such practices uld include the eradication of weeds, irrigation and fertilization where pos-le. However, land use on the shallow soils will have to be based on a minimum capital expenditure because of the low market value of the land and it is likely that such practices would be advantageous at the present time.

Texture

This term refers to the relative proportion of sand, silt and clay that mak up the soil material. The texture in most soils changes from horizon to horizo and extremes are often present when one kind of deposit overlies another. I many of the soil series described the subsoil or B horizon contains more cla than the soil above or below it.

The classes of soil texture start with sand which has only a little silt and clay Then with increasing amounts of clay the principal classes are loamy sand, sand loam, loam, silt loam, clay loam and clay. The classes can be distinguished b squeezing a moist sample between the fingers. The sands are harsh and gritt and the particles scarcely hold together. At the other extreme clay can be rolle into a smooth sticky ball.

In general, soils of intermediate texture such as sandy loams, loams and sil loams are easiest to handle. Sands and loamy sands are open and water drain readily through them so they hold rather small quantities of water and are sai to be droughty soils. However, their water holding capacity can be increased t some extent by adding liberal amounts of barnyard manure or other forms o organic material. Clays, on the other hand, tend to become hard and stick to gether in clods unless they are handled carefully.

Structure

The individual soil particles — sand, silt or clay — group themselves to form various kinds of aggregates which are called structure. The ideal structures ar those which are small and soft such as granular or crumb. The next best are th small blocky nut-like aggregates, between which water and roots can move.

The formation of desirable soil aggregates is generally enhanced by organi matter, that is the dead portions of plant materials which are added to soil either by the death of plants at the surface or the decay of plant roots. In culti vated soils where crops are continually being removed there is little return mad to the soil of this very important material.

In sandy soils each grain of sand is often by itself. Clayey soils on the othe hand, if deficient in organic matter, becomes cloddy if ploughed when too we or too dry. Wherever they occur within the depth of normal rooting of plant such hard, cloddy soils must be reworked to make them granular or blocky. It i not enough to break up massive clods. Organic matter must be added as is don by the addition of barnyard manure or the ploughing down of green manure i order that fragments will not flow back together into masses when they are we again.

Drainage

Poorly drained soils are rarely, if ever, productive. It is possible for gras crops to survive and frequently flourish under extremely wet conditions but mos cultivated plants cannot remain too long in soils that are saturated with wate

In most cases the drainage condition of the soil can be determined by it position in the landscape. Often, however, there is little evidence in the surfac soil alone of poor drainage beneath. Therefore it is important that such condi

tions be identified by an examination of the soil profile. The conditions of soil drainage are indicated fairly reliably by soil colours. Bright solid colours of brown or yellow suggest fairly good drainage, but in low ground, grey and mottled horizons indicate poor drainage.

A summary of the drainage conditions of the soils occurring on Manitoulin Island is given in the following table.

TABLE 8
DRAINAGE OF MANITOULIN ISLAND SOILS

Drainage Class	Acreage	% of Total Area	Arable (Acres)	Non-Arable (Acres)
Good	558,500	79.8	98,600	459,900
Imperfect	67,300	10.7	65,000	2,300
Poor	40,000	6.0	20,700	19,300
Very Poor	25,800	3.5	—	25,800

The remedy that must be applied to conditions of poor drainage must be letermined for each individual field. Where open ditches and high crowns may ɔe satisfactory for one field, tile drainage may only be suitable for another. In all ases the cost of installation and maintenance of a drainage system in relation to he price of the crop produced, will need to be considered.

Jutrients

Nutrients are the food that plants derive from the soil. They cannot be ɛen in the soil but they can be estimated from the vigor of growing plants. A ıeasure of nutrients contained in the soil can be obtained accurately in the ıboratory from samples collected by the individual farmer. Soil sample boxes nd the procedure for collecting samples can be obtained from the office of the ɔcal Agricultural Representative at Gore Bay. The samples are tested free charge in the laboratory at the Agricultural College, Guelph.

Some general statements can be made with respect to the nutrient elements ıat will apply to all soils occurring in this area.

One of the most important conditions required for good plant growth that there be a balance of plant nutrients in the soil. All plants take at ast 12 essential elements from the soil. The most common elements found be deficient are nitrogen, phosphorus and potassium. These are the elements ntained in mixed fertilizers. Calcium and magnesium are included in liming aterials and small amounts are usually present in mixed fertilizers. The other ɛments used in lesser amounts are sulphur, iron, boron, manganese, copper, ıc and molybdenum.

Each of the above elements is contained in manure, but since it would ke a long time to build up the phosphorus content of a phosphorus deficient il with manure alone, it is more practical to use chemical fertilizer in dition to organic matter. Deficiencies of nitrogen can be remedied by ınure, nitrogenous fertilizers or by the growing of leguminous crops such as l clover and alfalfa particularly if it is ploughed down while a good stand is ll remaining. But only a part of the phosphorus and sulphur supplied to ops is derived from this organic matter. The remaining portion is derived m the inorganic fraction of the soil.

The inorganic or mineral fraction makes up the bulk of most soils. It is derived from rocks of various kinds and their degradation products. The nutrient supplying power of the larger particles – that is, the sand and silt – are quite different from those of the fine particles or clay fraction. Since the nutrient elements are held in the soil mainly by the finer particles, clay textured soils are commonly considered to have a higher nutrient supply than coarser textured soils.

In order to estimate the amounts of fertilizer that it is necessary to apply to achieve a balance of plant nutrients in the soil several things need to be determined: the nutrients already in the soil, plus those normally added in manure; the general requirements of the plants to be grown; and the amounts of the nutrients contained in the various fertilizer materials available for use.

This information is being obtained for a great many specific soil types by the research being done on experimental stations and experimental farms and by soil testing laboratories. Differences in climate, soil, and plants mean that the research must be conducted in many locations. For localities in which no research results are available, recommendations are based on results obtained in related conditions.

Experiments conducted at the District Experimental Substation at Mindemoya indicate that the use of phosphorus alone or in combination with potash and nitrogen gave the largest increases in yields of the crops tested. Nitrogen and potassium alone produced less consistent results but complete fertilizer at moderate rates produced increased yields. The complete fertilizers in the case of most soils should contain substantial amounts of phosphorus, medium levels of potassium and variable amounts of nitrogen depending on other manurial treatments. Manure gives increased yields on all soils. It not only supplies nitrogen and to a lesser degree phosphorus and potassium but also improves the physical condition and increases the moisture holding capacity of the soil. In general the nitrogen needed for the grain crops can be supplied by growing legumes. In this way the nitrogen is supplied and the soil is kept in good physical condition. For specific recommendations with regard to fertilizer analyses and rates to be used on crops grown on the Island the reader is referred to the recommendations given by the Advisory Fertilizer Board for Ontario.

Lime is deficient in some of the soils on Manitoulin Island. Lime is required on the Wendigo, Mallard, Thwaites, Casey, Bucke, and Otterski soils. Soil tests should be used to determine the need for lime on the other soils of the surveyed area. The limestone rock in the area could be used as a source of lime if crushed and finely pulverized. For quick effects, it is desirable to use a product the most of which will pass through a 100-mesh screen.

Sources of Information

Agricultural colleges and the Experimental Farm system can give much information that is useful in solving soil management problems for any particular

region. Experimental work is being done at the District Experimental Substation at Mindemoya and the Illustration Stations at Manitowaning and Gore Bay and information can be obtained on the uses of fertilizer, the testing of new crops and the various farm practices that apply to Manitoulin Island from these places. If information is needed about the soil itself this can best be obtained by collecting soil samples, as directed by the Agricultural Representative, and mailed to the Soils Department, Ontario Agricultural College, Guelph.

Further information on crops can be obtained from the Research Branch, Central Experimental Farm, Ottawa and the Field Husbandry Department, Ontario Agricultural College.

Ratings of the Soils According to Their Suitability for Different Crops

Although the soils listed in this report have characteristics by which they differ from one another, many of these characteristics have only a slight effect on the ability of the soil to produce crops. There are therefore, many soils which should have approximately equal potentials in crop production and may be grouped together for that purpose.

It is recognized that a poor soil that is well managed may outyield a good soil poorly managed. In the ratings given no assessment has been made of the effect that a particular kind of management may have on the crop potentials of the soils but it is assumed that the normal farm practices are carried out on all the soils listed. The different soil types and phases have been placed in one of six

Oat crop on Evanturel silt loam.

groups namely, good cropland, good to fair cropland, fair cropland, fair to poo cropland, poor cropland and unsuitable for crops.

This rating represents an estimate of the crop producing ability of the soi based on the characteristics of the soil itself and the crops observed on the soil together with information supplied by farmers and experimental workers. Al though the reliability of these groupings have not been verified by crop yiel figures they have in other counties proven to be reasonably accurate for purpose of farm management and land use planning.

The meanings of the letters used in the tables are as follows: G-Good, G-F Good to Fair, F-Fair, F-P Fair to Poor, P-Poor.

TABLE 9
CROP ADAPTABILITY RATINGS FOR GOOD CROPLAND

Soil Type	Oats	Mixed Grains	Alfalfa	Red Clover	Alsike	Timothy	Potatoes	Pastur
Earlton silt loam	G	G	F	G	G	G	F	G
Gordon silty clay loam	G-F	G-F	F	G	G	G	F	G
Evanturel silt loam	G-F	G-F	G-F	G	G	G	F-P	G
Campbell silty clay loam	G-F	F	F	G-F	G-F	G	F-P	G

The soil types included in this group give higher yields and are adaptabl to a greater variety of crops than any other soils occurring in the district. The possess the ideal texture for this region; they are stone free and have sufficien depth for root development and storage of moisture. The Earlton and Gordo soils can be improved by draining and in this respect are inferior to the Campbel and Evanturel soils. The latter are subject to surface erosion by water, a problen that is serious only where the soil is left bare during heavy rainy seasons.

TABLE 10
CROP ADAPTABILITY RATINGS FOR GOOD TO FAIR CROPLAND

Soil Type	Oats	Mixed Grains	Alfalfa	Red Clover	Alsike	Timothy	Potatoes	Pastur
Buzwah clay loam	F	F	G-F	G-F	G-F	G-F	P	G-F
Buzwah silty clay loam	F	F	G-F	G-F	G-F	G-F	P	G-F
Burford loam	G-F	G-F	F	F	F	F	F	G-F
Thwaites silt loam	G-F	G-F	F-P	F-P	F	G-F	G-F	G-F

The soils in this group possess certain limitations in crop production tha make them less suitable and less productive than the previous group. The Burfor soils have only a moderate water holding capacity and are frequently ston The Thwaites soil is susceptible to water erosion. The Buzwah soils are ston and the stones are so numerous that they must be removed before cultivatio In general these soils produce only moderate yields of oats and mixed grain but are probably as good as the first group of soils in the production of hay Satisfactory yields of grain or hay require frequent use of commercial fertilizer Some application of lime may also be necessary on the Thwaites soils.

TABLE 11
CROP ADAPTABILITY RATINGS FOR FAIR CROPLAND

Soil Type	Oats	Mixed Grains	Alfalfa	Red Clover	Alsike	Timothy	Potatoes	Pasture
Vasey silt loam	F	F	F-P	F-P	F	F	G	F
Carlton silt loam—shallow phase	F	F	F-P	F-P	F	F	F	G-F
Campbell silty clay loam—shallow phase	F	F	F-P	F	F	F	F-P	F
Evanturel silt loam—shallow phase	F	F	F-P	F	F	F	F-P	F
Gordon silty clay loam—shallow phase	F	F	F-P	F-P	F	F	F-P	F
Burford sandy loam	F-P	F-P	F	F	F	F	F-P	F
Lane silt loam	F	F	P	F-P	F	F	F-P	F
Vasey loam	F	F	F-P	F	F	F	P	F-P
Volsey silty clay loam	F-P	F-P	P	F	F	F	P	F
Dumfries loam	F-P	F-P	P	F	F	F	P	F-P

This group includes those soils which have severe limitations in crop production, as a result of poor texture or shallowness over bedrock. Both of these conditions control the moisture supply in the soil so that cereal and hay crops are affected in spite of good management practices. Stones interfere with cultivation on the Vasey and Dumfries soils and require constant removal as they occur in the soil mass as well as at the surface.

These soils can be used for growing both grain and hay but such crops will require the use of commercial fertilizers. Since the yields of grain can be expected to be lower on these soils than on the soils of the better groups, cost of production may eliminate their use for that purpose.

TABLE 12
CROP ADAPTABILITY RATINGS FOR FAIR TO POOR CROPLAND

Soil Type	Oats	Mixed Grains	Alfalfa	Red Clover	Alsike	Timothy	Potatoes	Pasture
Beech clay loam	F-P	F-P	F-P	F	F	F	P	F-P
Beech silty clay loam	F-P	F-P	F-P	F	F	F	P	F-P
Muzwah clay loam—shallow phase	F-P	F-P	F-P	F-P	F	F	P	F
Connybrook sandy loam	P	P	F	F	F	F	P	F
Lucke fine sandy loam	F-P	F-P	P	P	F-P	F	G-F	F-P
Wendigo fine sandy loam	F-P	F-P	P	P	P	F	G-F	F-P
Beech silty clay loam—shallow phase	F-P	F-P	F-P	F-P	F	F	P	F
Beech clay loam—shallow phase	F-P	F-P	F-P	F-P	F	F	P	F
Lake clay	F-P	P	F-P	F-P	F-P	F	P	F
Otterskin fine sandy loam	F-P	F-P	P	P	P	F-P	F	F-P
Burford loam—shallow phase	P	P	F-P	F-P	F-P	F-P	P	F
Disbane loam	F-P	P	P	F-P	F-P	F-P	P	F-P
Lowland loam	F-P	F-P	P	P	F-P	F-P	P	F-P

The soil types included in this group possess characteristics that limit their suitability to a few crops or to agricultural uses that do not require cultivation. The problems associated with these soils are drainage, shallowness, low fertility, susceptibility to erosion and stoniness. Any one or a combination of several of these problems may be associated with a particular soil in this group. A soil may be improved without entirely correcting or overcoming the problem. Such im-

provement, although only partial improvement for potential hay and pastur land, may be economical. The soil types that have some potential uses for cereal are the Leech soils.

TABLE 13
CROP ADAPTABILITY RATINGS FOR POOR CROPLAND

Soil Type	Oats	Mixed Grains	Alfalfa	Red Clover	Alsike	Timothy	Potatoes	Pastur
Howland sandy loam	F-P	P	P	P	F-P	F-P	P	F-P
Bucke sandy loam	F-P	F-P	P	P	P	P	F-P	F-P
Bass clay	F-P	F-P	P	P	P	F-P	P	F-P
Vasey loam—shallow phase	P	P	P	F-P	F-P	F-P	P	F-P
Wolsey silty clay loam—shallow phase	F-P	F-P	P	P	P	F-P	P	F-P
Otterskin sandy loam	F-P	F-P	P	P	P	P	F-P	P
Cane silt loam—shallow phase	P	P	P	P	P	F-P	P	F
Howland loam—shallow phase	P	P	P	P	F-P	F-P	P	F-P
Englehart fine sandy loam	P	P	P	P	P	F-P	P	F-P
Wendigo sandy loam	P	P	P	P	P	P	F-P	P
Wendigo sand	P	P	P	P	P	P	F-P	P
Phipps clay loam	P	P	P	P	P	P	P	F-P
Phipps silty clay loam	P	P	P	P	P	P	P	F-P
Englehart sandy loam	P	P	P	P	P	P	P	P
Mallard sandy loam	P	P	P	P	P	P	P	P

This group includes a large number of minor soil types which are used chiefl for grazing or for forestry. However, many of the soil types here could be use for growing a wider range of crops if improved. Soils such as Wendigo sand loam, Bucke sandy loam, Otterskin sandy loam and Mallard sandy loam ar being used successfully for specialized crops elsewhere in the province.

TABLE 14
NON-ARABLE LAND

Wolsey silty clay loam—stony phase
Campbell silty clay loam—shallow, stony phase
Gordon silty clay loam—shallow, stony phase
Kagawong silt loam
Phipps clay loam—shallow phase
Bass clay—stony phase
Perch clay
Leech silty clay loam—stony phase
Cane silt loam—stony phase
Wolsey silty clay loam—shallow, stony phase
Phipps silty clay loam—stony phase
Perch clay—stony phase
Buzwah silty clay loam—stony phas
Farmington loam
Little Current clay
Donnybrook sandy loam
Evanturel silt loam—stony phase
Earlton silt loam—stony phase
Campbell silty clay loam—stony phas
Gordon silty clay loam—stony phase
Pike clay—stony phase
Muck

The soils included in this group comprise about 72 per cent of the lan area of Manitoulin Island. With the exception of the Farmington soils mos of them occur as small isolated areas and can serve as woodlots or grazing land The Farmington soils make up 60 per cent of the land area and although the are unsuitable for the growing of cultivated crops they are the grazing land soil of Manitoulin Island.

TABLE 15
UNSUITED FOR AGRICULTURE

Gilford loam	Lyons loam—shallow phase
Gilford sandy loam	Bridgman sand
Killean loam	Burpee muck
Lily loam	Marsh
Lyons loam	Rock—Wendigo
Kenabeek sandy loam	Rock
Mallard sandy loam—shallow phase	
Mallard sandy loam—stony phase	

The soils included in this group are unsuited to agriculture since they cannot be cultivated nor can they be used for grazing. In some places the soils are covered with stones and trees and grass is sparse; in others, there is no cover of any kind and the bare rock or soil materials are exposed. The soils should be reforested.

APPENDIX

TAXONOMIC CLASSIFICATION, PROFILE DESCRIPTIONS AND ANALYTICAL DATA

In the following pages profile descriptions of each soil series are presented together with analytical data for selected soils. The analyses of surface samples are included to indicate comparative levels of plant nutrients in the surface soils of the island.

The methods of analysis were as follows:

Mechanical Analysis	—	Bouyoucos Hydrometer Method, Soil Science, Vol. 42, 1936, p. 225.
Reaction	—	Atkinson H. J. et al., Contribution 169, Canada Department of Agriculture 1955.
Base Exchange Capacity and Exchangeable Bases	—	Schollenberger Method, Soil Science, 51:1, 1945.
Organic Matter	—	Walkley Method, Soil Science 63:251-264, 1947.
Calcium and Magnesium	—	Cheng Methods, Soil Science 72:449-558, 1951 and Soil Science 75:37-40, 1953.
Fusion Analysis	—	Robinson Method, Soil Science 59:7-9, 1945.

DUMFRIES SERIES

LOCALITY: Lot 3, Con. VI, Howland Twp.

PARENT MATERIAL: Stony calcareous, sandy loam till

*CLASSIFICATION: Great Soil Group — Grey-Brown Podzolic
Soil Group — Orthic Grey-Brown Podzolic
Family — Dumfries

DESCRIPTION: A_0 — Thin layer of partially decomposed leaves, twigs, etc.

A_1 — 0-3 inches loam; dark brown (10 YR 4/3); fine granula structure; friable consistency; frequent stones; pH — 6.5

A_{21}—3-6 inches loam; yellowish brown (10 YR 5/4); weak platy friable; few stones; pH — 6.3.

A_{22}—6-10 inches loam; pale brown (10 YR 6/3); weak platy friable; occasional stones; pH — 6.0.

B_1 — 10-13 inches loam; dark yellowish brown (10 YR 4/4) fine nuciform; friable; moderately stony; pH — 6.5.

B_2 — 13-20 inches clay loam; dark brown (10 YR 4/3); mediur nuciform; friable; very stony; pH — 7.0.

C — Stony sandy loam till; light grey (10 YR 7/2); single grain loose; calcareous; pH — 7.8.

*The classification of each series, into Soil Group and Family is made on the basis of th definitions given by the National Soil Survey Committee 1958.

KILLEAN SERIES

LOCALITY: Lot 5, Con. IV, Howland Twp.

PARENT MATERIAL: Stony, calcareous, sandy loam till

CLASSIFICATION: Great Soil Group — Grey-Brown Podzolic
Soil Group — Gleyed Grey-Brown Podzolic
Family — Killean

DESCRIPTION: A_0 — Thin layer of partially decomposed leaves, twigs, etc.
A_1 — 0-5 inches loam; very dark greyish brown (10 YR 3/2); fine granular structure; friable consistency; pH — 6.8.
A_2 — 5-12 inches loam; yellowish brown (10 YR 5/4); slightly mottled; weak platy; friable; very stony; pH — 6.4.
B_2 — 12-20 inches loam; dark brown (10 YR 4/3); mottled; medium nuciform; friable; very stony; pH — 7.0.
C — Stony sandy loam till; light grey (10 YR 7/2); single grain; loose; many stones and boulders; calcareous; pH — 7.4.

LILY SERIES

LOCALITY: Lot 3, Con. IV, Howland Twp.

PARENT MATERIAL: Stony, calcareous, sandy loam till

CLASSIFICATION: Great Soil Group — Dark Grey Gleisolic
Soil Group — Orthic Dark Grey Gleisolic
Family — Lyons

DESCRIPTION: A_0 — Thin layer of partially decomposed leaves, twigs, etc.
A_1 — 0-7 inches loam; black (10 YR 2/1); fine granular structure; friable consistency; very stony; pH — 7.2.
G — 7-20 inches loam; greyish brown (10 YR 5/2); very mottled; weak medium nuciform; friable; very stony; pH — 7.3.
C — Coarse sandy loam till; light grey (10 YR 7/2); many stones and boulders; calcareous; pH — 7.6.

VASEY SERIES

LOCALITY: Lot 21, Con. IX, Robinson Twp.

PARENT MATERIAL: Calcareous, loam or sandy loam till

CLASSIFICATION: Great Soil Group — Grey-Brown Podzolic
Soil Group — Bisequa Grey-Brown Podzolic
Family — Vasey

DESCRIPTION: A_0 — Thin layer of partially decomposed leaves, twigs, etc.
A_1 — 0-2 inches loam; very dark greyish brown (10 YR 3/2); medium granular structure; friable consistency; very stony; pH — 5.6.
B_{21p} — 2-12 inches loam; dark brown (7.5 YR 4/4); weak medium nuciform; friable; moderately stony; pH — 5.8.
B_{22p} — 12-19 inches loam; yellowish brown (10 YR 5/6); weak fine nuciform; friable; moderately stony; pH — 6.0.

TABLE 16
CHEMICAL AND PHYSICAL ANALYSES OF VASEY LOAM

Horizon	Mechanical Analyses			pH	% O.M.	Exchange Capacity m.e./100 gm.	Exchangeable Bases			SiO_2 %	R_2O_3 %	Fe_2O_3 %	Al_2O_3 %	CaO %	MgO %	K_2O %
	% Sand 1-.05 mm	% Silt .05-.002 mm	% Clay <.002 mm				Ca m.e./100 gm.	Mg m.e./100 gm.	K m.e./100 gm.							
A_1	49.7	38.2	12.1	5.6	3.3	14.7	10.7	2.5	0.1	71.6	18.7	4.8	15.2	2.4	1.2	2.8
B_{21}	47.2	40.0	12.8	5.8	0.4	5.6	3.6	0.8	0.08	70.8	18.9	5.4	15.3	2.3	0.9	2.7
B_{22}	48.4	40.4	11.2	6.0	0.1	5.1	3.1	0.7	0.06	70.6	20.2	5.1	15.7	2.4	0.8	2.6
A_2G.B.P.	52.1	36.9	11.0	6.1	0.0	4.0	2.8	0.4	0.04	78.3	14.3	2.3	11.9	1.9	0.6	2.6
B_2G.B.P.	49.2	35.2	15.6	6.7	0.0	7.3	6.0	0.9	0.1	70.2	20.4	5.9	15.4	2.7	1.1	2.7
C	57.9	30.5	11.6	7.8	0.0	3.9	16.5	2.1	0.08	66.6	18.6	5.0	12.6	7.6	2.3	2.5

A_{2gbp}—19-30 inches loam; very pale brown (10 YR 7/4); weak fine platy; friable; moderately stony; pH — 6.1.

B_{2gbp}—30-34 inches loam; yellowish brown (10 YR 5/4); weak medium nuciform; friable; moderately stony; pH — 6.7.

C — Loam till; pale brown (10 YR 6/3); friable; very stony; calcareous; pH — 7.8.

HOWLAND SERIES

LOCALITY: Lot 51, Con. II, Assiginack Twp.

PARENT MATERIAL: Calcareous, loam or sandy loam till

CLASSIFICATION: Great Soil Group — Grey-Brown Podzolic
Soil Group — Gleyed Grey-Brown Podzolic
Family — London

DESCRIPTION: A_0 — Thin layer of partially decomposed leaves, twigs, etc.

A_1 — 0-3 inches loam; very dark greyish brown (10 YR 3/2); medium granular structure; friable consistency; very stony; pH — 6.0.

A_{21}—3-14 inches loam; brown (10 YR 5/3); slightly mottled; weak medium nuciform; friable; moderately stony; pH —6.3.

A_{22}—14-23 inches loam; light yellowish brown (10 YR 6/4); mottled; weak fine nuciform; friable; moderately stony; pH — 6.4.

B_2 — 23-26 inches loam; yellowish brown (10 YR 5/6); mottled; weak fine nuciform; friable; moderately stony; pH — 7.0.

C — Loam till; pale brown (10 YR 6/3); friable; very stony; calcareous; pH — 7.8.

LYONS SERIES

LOCALITY: Lot 29, Con. XI, Dawson Twp.

PARENT MATERIAL: Calcareous, loam or sandy loam till

CLASSIFICATION: Great Soil Group — Dark Grey Gleisolic
Soil Group — Orthic Dark Grey Gleisolic
Family — Lyons

DESCRIPTION: A_0 — Thin layer of partially decomposed leaves, twigs, etc.

A_1 — 0-6 inches loam; black (10 YR 2/1); medium granular structure; friable consistency; very stony; pH — 7.4.

G — 6-20 inches loam; dark grey (10 YR 4/1); very mottled; weak medium nuciform; friable; very stony; pH — 7.0.

C — Loam till; light yellowish brown (10 YR 6/4); very mottled; very stony; calcareous; friable; pH — 7.8.

BUZWAH SERIES

LOCALITY: Lot 15, Con. II, Tehkummah Twp.

PARENT MATERIAL: Layers of reddish clay loam till and greyish loam till; often mixed to form variegated colored till. Tills derived from Medina and Trenton bedrock.

CLASSIFICATION: Great Soil Group — Grey Wooded
Soil Group — Orthic Grey Wooded
Family — Haileybury

DESCRIPTION: A_0 — Thin layer of partially decomposed leaves, twigs, etc.
A_1 — 0-2 inches clay loam; very dark greyish brown (10 YR 3/2) medium granular structure; friable consistency; very stony pH — 6.2.
A_{21}—2-5 inches clay loam; yellowish brown (10 YR 5/6); mediun granular; friable; very stony; pH — 6.0.
A_{22}—5-15 inches loam; very pale brown (10 YR 7/4); weak fin platy; friable; moderately stony; pH — 5.7.
AB—15-20 inches clay loam; yellowish brown (10 YR 5/4) medium nuciform; firm; aggregates coated with very pal brown material; stony; pH — 6.4.
B_2 — 20-26 inches clay loam; dark brown (7.5 YR 4/4); mediun nuciform; firm; very stony; pH — 6.8.
C — Clay loam till; pinkish grey (7.5 YR 6/2); and pale brow (10 YR 6/3); hard; calcareous; moderately to very stony pH — 7.8.

TABLE 17

CHEMICAL AND PHYSICAL ANALYSES OF THE CULTIVATED SURFACE OF SOME BUZWAH SOILS

Horizon	Location			Mechanical Analyses			Ex-change Capacity m.e./100 gm.	Exchangeable Bases			pH	% O.M
	Township	Conc.	Lot	% Sand 1-.05 mm	% Silt .05-.002 mm	% Clay <.002 mm		Ca m.e./ 100 gm.	Mg m.e./ 100 gm.	K m.e./ 100 gm.		
Cultivated Surface	Sandfield	VI	22	31.0	41.2	27.8	20.18	13.57	1.66	0.15	5.9	6.0
" "	Sandfield	IV	15	33.4	42.4	24.2	23.75	16.95	2.81	0.17	6.2	8.2
" "	Tehkummah	III	20	34.8	34.0	31.2	24.17	18.94	2.04	0.13	6.4	5.5
" "	Sandfield	XI	16	34.5	36.0	29.5	28.66	21.32	4.47	0.24	6.5	8.7
" "	Assiginack	II	27	37.2	23.1	39.7	25.76	24.36	3.73	0.45	6.8	7.5

LEECH SERIES

LOCALITY: Lot 45, Con. II, Assiginack Twp.

PARENT MATERIAL: A variegated layering of calcareous clay loam and loa tills.

CLASSIFICATION: Great Soil Group — Grey Wooded
Soil Group — Gleyed Grey Wooded
Family — Renfrew

DESCRIPTION: A_0 — Thin layer of partially decomposed leaves, twigs, etc.
A_1 — 0-2 inches clay loam; very dark greyish brown (10 YR 3/2 fine nuciform structure; friable consistency; moderatel stony; pH — 6.4.

A_2 — 2-9 inches clay loam; very pale brown (10 YR 7/3) ; mottled; weak fine platy; friable; moderately stony; pH — 6.0.

AB—9-12 inches clay loam; pale brown (10 YR 6/3); mottled; medium nuciform; firm; aggregates coated with very pale brown material; stony; pH — 6.4.

B_2 — 9-18 inches clay loam; brown (7.5 YR 5/2) ; mottled; fine blocky; plastic when wet, hard when dry; moderately stony; pH — 6.8.

C — Clay loam till; pinkish grey (7.5 YR 6/2) ; and grey (10 YR 6/1) ; hard; calcareous; moderately stony; pH — 7.8.

PHIPPS SERIES

LOCALITY: Lot 10, Con VII, Barrie Island

PARENT MATERIAL: A variegated layering of calcareous clay loam and loam till

CLASSIFICATION: Great Soil Group — Dark Grey Gleisolic
Soil Group — Orthic Dark Grey Gleisolic
Family — Brookston

DESCRIPTION: A_0 — Thin layer of partially decomposed leaves, twigs, etc.

A_1 — 0-5 inches clay loam; black (10 YR 2/1); fine nuciform structure; friable consistency; moderately stony; pH — 6.6.

G — 5-19 inches clay loam; grey (10 YR 5/1); very mottled; mottles strong brown (7.5 YR 5/6) in colour; coarse blocky; hard when dry, plastic when wet; moderately stony; pH — 7.0.

C — Clay loam till; pinkish grey (7.5 YR 6/2) and grey (10 YR 6/1) ; very mottled; hard when dry, plastic when wet; calcareous; moderately stony; pH — 8.0.

DONNYBROOK SERIES

LOCALITY: Lot 6, Con. VII, Howland Twp.

PARENT MATERIAL: Stony, gravelly, calcareous outwash

CLASSIFICATION: Great Soil Group — Grey-Brown Podzolic
Soil Group — Orthic Grey-Brown Podzolic
Family — Dumfries

DESCRIPTION: A_0 — Thin layer of partially decomposed leaves, twigs, etc.

A_1 — 0-4 inches gravelly sandy loam; dark grey-brown (10 YR 4/2) ; fine crumb structure; very friable consistency; moderately to very stony; pH — 7.2.

A_{21}—4-6 inches gravelly sandy loam; yellowish brown (10 YR 5/6) ; weak fine platy; very friable; pH — 6.9.

A_{22}—6-10 inches gravelly sandy loam; pale brown (10 YR 6/3); single grain; loose; pH — 6.7.

B_2 — 10-16 inches gravelly sandy loam; dark brown (10 YR 4/3); weak fine nuciform; friable; very stony; pH — 7.2.

C — Sand and gravel; very pale brown (10 YR 7/3); single grain; loose; calcareous; very stony; pH — 8.0.

TABLE 18
CHEMICAL AND PHYSICAL ANALYSES OF WENDIGO SANDY LOAM

Horizon	Mechanical Analyses			pH	O.M. %	Exchange Capacity m.e. 100 gm.	Exchangeable Bases			SiO_2 %	R_2O_3 %	Fe_2O_3 %	Al_2O_3 %	CaO %	MgO %	K_2O %
	% Sand 1-.05 mm	% Silt .05-.002 mm	% Clay <.002 mm				Ca m.e./ 100 gm.	Mg m.e./ 100 gm.	K m.e./ 100 gm.							
A_2	70.3	27.0	2.7	4.8	0.62	2.18	0.39	0.17	0.04	82.7	11.6	0.8	10.4	1.4	0.1	2.1
B_2	81.3	16.4	2.3	5.6	0.93	4.53	0.28	0.14	0.07	74.2	16.4	3.0	13.2	2.1	0.6	1.8
B_3	86.8	13.6	1.6	5.9	0.35	2.62	0.45	0.18	0.04	75.6	15.9	2.8	12.9	2.1	0.7	1.8
C	95.6	4.2	0.2	6.2	0.00	0.91	0.11	0.05	0.02	75.6	15.5	2.8	12.6	2.3	1.0	1.9

WENDIGO SERIES

Locality: Lot 8, Con. VI, Billings Twp.
Parent Material: Non-calcareous outwash sand
Classification: Great Soil Group — Podzol
Soil Group — Orthic Podzol
Family — Wendigo

Description: A_0 — 1-0 inches raw humus and roots; very dark grey (10 YR 3/1); pH — 5.2.
A_2 — 0-3 inches sand; white (10 YR 8/2); single grain structure; loose consistency; pH — 5.0.
B_{21}—3-12 inches sand; yellowish brown (10 YR 5/8); single grain; loose; pH — 5.5.
B_{22}—12-26 inches sand; light yellowish brown (10 YR 6/4); single grain; loose; pH — 5.8.
C — Sand; very pale brown (10 YR 7/2); single grain; loose; non-calcareous; pH — 6.0.

MALLARD SERIES

Locality: Lot 12, Con. VIII, Billings Twp.
Parent Material: Non-calcareous outwash sand
Classification: Great Soil Group — Podzol
Soil Group — Gleyed Podzol
Family — Rubicon

Description: A_0 — 1-0 inches raw humus and roots, very dark grey (10 YR 3/1); pH — 5.0.
A_2 — 0-4 inches sandy loam; white (10 YR 8/2); single grain structure; loose consistency; pH — 4.5.
B_2 — 4-20 inches sandy loam; brown (10 YR 5/3); mottled; single grain; occasionally cemented; pH — 5.6.
C — Sandy loam; pale brown (10 YR 7/3); mottled; single grain; pH — 6.1.

KENABEEK SERIES

Locality: Lot 11, Con. VII, Billings Twp.
Parent Material: Non-calcareous outwash sand
Classification: Great Soil Group — Dark Grey Gleisolic
Soil Group — Orthic Dark Grey Gleisolic
Family — Kenabeek

Description: A_1 — 0-5 inches sandy loam; very dark brown (10 YR 2/2); highly organic; fine crumb structure; friable consistency; pH — 5.2.
G — 5-18 inches sandy loam; grey (10 YR 6/1); very mottled; single grain; loose; pH — 6.0.
C — Sandy loam; very pale brown (10 YR 7/3); very mottled; single grain; loose; pH — 6.6.

BURPEE SERIES

LOCALITY: Lot 21, Con. XIII, Campbell Twp.
PARENT MATERIAL: Non-calcareous outwash sand
CLASSIFICATION: Great Soil Group — Gleysol
Soil Group — Peaty Gleysol
Family — Burpee
DESCRIPTION: A_0 — 6-0 inches; well decomposed organic material; black (1 YR 2/1); pH — 6.5.
G_1 — 0-12 inches sand; greyish brown (10 YR 5/2); slightl mottled; single grain structure; loose consistency; pH — 6.7
G_2 — 12-24 inches sand; brown (10 YR 5/3); slightly mottled single grain; loose; pH — 6.8.
C — Sand; dark greyish brown (10 YR 4/2); slightly mottled single grain; loose; pH — 6.9.

BURFORD SERIES

LOCALITY: Lot 3, Con. I, Billings Twp.
PARENT MATERIAL: Loam and sandy loam deposits underlain by gravel
CLASSIFICATION: Great Soil Group — Grey-Brown Podzolic
Soil Group — Orthic Grey-Brown Podzolic
Family — Burford
DESCRIPTION: A_0 — Thin layer of partially decomposed leaves, twigs, etc.
A_1 — 0-3 inches loam; very dark greyish brown (10 YR 3/2) fine granular structure; friable consistency; few stones pH — 6.0.
A_{21}—4-17 inches loam; yellowish brown (10 YR 5/4); weak fin platy; very friable; few stones; pH — 5.4.
A_{22}—17-20 inches gravelly loam; light yellowish brown (10 YI 6/4); weak fine platy; very friable; pH — 6.2.
B_2 — 20-33 inches gravelly loam; dark brown (10 YR 4/3) medium nuciform structure; hard consistency; gravelly moderately stony; pH — 6.8.
D — Gravel and sand; pale brown (10 YR 6/3); single grai structure; loose consistency; calcareous; pH — 7.8.

BRISBANE SERIES

LOCALITY: Lot 27, Con. VI, Howland Twp.
PARENT MATERIAL: Loam and sandy loam deposits underlain by gravel
CLASSIFICATION: Great Soil Group — Grey-Brown Podzolic
Soil Group — Gleyed Grey-Brown Podzolic
Family — Brady
DESCRIPTION: A_0 — Thin layer of partially decomposed leaves, twigs, etc.
A_1—0-6 inches loam; very dark greyish brown (10 YR 3/2) fine granular structure; friable consistency; moderatel stony; pH — 6.6.
A_2 — 6-10 inches loam; yellowish brown (10 YR 5/4); slightl mottled; weak fine platy; friable; very stony; pH — 6.0.

B_2 — 10-22 inches gravelly loam; dark brown (10 YR 4/3); mottled; medium nuciform; firm; moderately stony; pH — 7.0.

D — Gravel and sand; pale brown (10 YR 6/3); single grain; loose, calcareous; pH — 7.8.

GILFORD SERIES

LOCALITY: Lot 30, Con. V, Howland Twp.

PARENT MATERIAL: Loam and sandy loam deposits underlain by gravel

CLASSIFICATION: Great Soil Group — Dark Grey Gleisolic
Soil Group — Orthic Dark Grey Gleisolic
Family — Granby

DESCRIPTION: A_0 — Thin layer of partially decomposed leaves, twigs, etc.

A_1 — 0-6 inches loam; very dark brown (10 YR 2/2); fine granular structure; friable consistency; very stony; pH — 7.0.

G — 6-16 inches loam; greyish brown (10 YR 5/2); mottled; medium blocky; friable; moderately stony; pH — 7.2.

D — Gravelly outwash; pale brown (10 YR 6/3); single grain; loose; calcareous; pH — 7.8.

BUCKE SERIES

LOCALITY: Lot 38, Con. VII, Burpee Twp.

PARENT MATERIAL: Non-calcareous outwash sand underlain by calcareous silty clay at depths of less than 3 feet

CLASSIFICATION: Great Soil Group — Podzol
Soil Group — Orthic Podzol
Family — Bucke

DESCRIPTION: A_0 — 1-0 inches raw humus and roots; very dark grey; (10 YR 3/1); pH — 5.2.

A_2 — 0-2 inches fine sandy loam; light grey (10 YR 7/2); single grain structure; loose consistency; stonefree; pH — 6.3.

B_{21}—2-9 inches fine sandy loam; (10 YR 5/8); single grain; loose; stonefree; pH — 6.3.

B_{22}—9-18 inches fine sandy loam; brownish yellow (10 YR 6/6); mottled; weak fine nuciform; loose; stonefree; pH — 6.4.

D — Silty clay; light brownish grey (10 YR 6/2); varved; very plastic when wet, very hard when dry; stonefree; calcareous; pH — 7.8.

OTTERSKIN SERIES

LOCALITY: Lot 7, Con. VII, Carnarvon Twp.

PARENT MATERIAL: Non-calcareous outwash sand underlain by calcareous silty clay at depths of less than 3 feet.

CLASSIFICATION: Great Soil Group — Podzol
Soil Group — Gleyed Podzol
Family — Locksley

DESCRIPTION: A_0 — 2-0 inches raw humus and roots; very dark grey (10 YR 3/1); pH — 5.0.

A_2 — 0-2 inches sandy loam; light grey (10 YR 7/1); single grain structure; loose consistency; stonefree; pH — 4.8.

B_{21}—2-18 inches sandy loam; yellowish brown (10 YR 5/6) mottled; single grain; loose; stonefree; pH — 5.4.

B_{22}—18-25 inches sandy loam; brownish yellow (10 YR 6/6) mottled; single grain; loose; stonefree; pH — 5.8.

D — Silty clay; light brownish grey (10 YR 6/2); varved; very plastic when wet, very hard when dry; stonefree; calcareous; pH — 7.8.

ENGLEHART SERIES

LOCALITY: Lot 18, Con. IV, Gordon Twp.

PARENT MATERIAL: Non-calcareous outwash sand underlain by calcareous silty clay at depths of less than 3 feet

CLASSIFICATION: Great Soil Group — Dark Grey Gleisolic
Soil Group — Orthic Dark Grey Gleisolic
Family — Kenabeek

DESCRIPTION: A_0 — Thin layer of partially decomposed leaves, twigs, etc.

A_1 — 0-5 inches fine sandy loam; very dark brown (10 YR 2/2) fine crumb structure; very friable consistency; stonefree; pH — 5.2.

G — 5-16 inches fine sandy loam; grey (10 YR 6/1); very mottled; single grain; loose; stonefree; pH — 5.4.

D — Silty clay; light brownish grey (10 YR 6/2); varved; very plastic when wet, very hard when dry; stonefree; pH — 7.8

THWAITES SERIES

LOCALITY: Lot 28, Con. IX, Billings Twp.

PARENT MATERIAL: Non-calcareous silt loam underlain by silty clay at depth of less than 3 feet

CLASSIFICATION: Great Soil Group — Grey Wooded
Soil Group — Bisequa Grey Wooded
Family — Evanturel

DESCRIPTION: A_0 — 1-0 inches raw humus and roots; very dark grey; (10 YR 3/1); pH — 5.2.

A_{2p} — 0-2 inches silt loam; white (10 YR 8/2); fine platy structure; soft consistency; stonefree; pH — 5.2.

B_{2p} — 2-10 inches silt loam; yellowish brown (10 YR 5/6); weak platy; soft; stonefree; pH — 5.3.

A_{2gw}— 10-18 inches silt loam; very pale brown (10 YR 7/3); weak platy; soft; stonefree; pH — 5.3.

B_{2gw}— 18-26 inches silty clay loam; yellowish brown (10 YR 5/4); medium nuciform; friable; stonefree; pH — 5.6.

D — Silty clay; light brownish grey; (10 YR 6/2); massive structure; very plastic when wet, very hard when dry; stonefree; calcareous; pH — 7.8.

CASEY SERIES

LOCALITY: Lot 26, Con. VII, Billings Twp.

PARENT MATERIAL: Non-calcareous silt loam underlain by calcareous silty clay at depths of less than 3 feet.

CLASSIFICATION: Great Soil Group — Grey Wooded
Soil Group — Gleyed Grey Wooded
Family — Earlton

DESCRIPTION: A_0 — 1-0 inches raw humus and roots; very dark grey; (10 YR 3/1); pH — 5.3.

A_{2p} — 0-2 inches silt loam; white (10 YR 8/2); fine platy structure; soft consistency; stonefree; pH — 5.0.

B_{2p} — 2-8 inches silt loam; yellowish brown (10 YR 5/8); slightly mottled; weak platy; soft; stonefree; pH — 5.2.

A_{2gw}— 8-15 inches silt loam; very pale brown (10 YR 7/3); mottled; weak platy; soft; stonefree; pH — 5.2.

B_{2gw}— 15-24 inches silty clay loam; brown (10 YR 5/3); mottled; medium nuciform; friable; stonefree; pH — 5.7.

D — Silty clay; light brownish grey (10 YR 6/2); massive; very plastic when wet, very hard when dry; stonefree; calcareous; pH — 7.8.

EVANTUREL SERIES

OCALITY: Lot 22, Con. II, Carnarvon Twp.

ARENT MATERIAL: Calcareous, stonefree, silt loam

LASSIFICATION: Great Soil Group — Grey Wooded
Soil Group — Bisequa Grey Wooded
Family — Evanturel

ESCRIPTION: A_0 — Thin layer of partially decomposed leaves, twigs, etc.

A_1 — 0-2 inches silt loam; grey (10 YR 5/1); medium granular structure; friable consistency; stonefree; pH — 6.1.

B_{2p} — 2-15 inches silt loam; light yellowish brown (10 YR 6/4); medium granular; friable; stonefree; pH — 5.6.

A_{2gw}— 15-18 inches silt loam; very pale brown (10 YR 8/3); fine platy; friable; stonefree; pH — 5.5.

AB_{gw}—18-23 inches silty clay loam; yellowish brown (10 YR 5/4); medium nuciform; firm; aggregates coated with very pale brown materials; stonefree; pH — 5.9.

B_{2gw}— 23-30 inches silty clay loam; yellowish brown (10 YR 5/4); medium blocky; firm; stonefree; pH — 6.2.

C_1 — 30-38 inches silt loam; pale brown (10 YR 6/3); mottled; mottles brownish yellow (10 YR 6/6); laminar; firm; stonefree; pH — 7.4.

C_2 — Silt loam; pale brown (10 YR 6/3); laminar; friable; stonefree; calcareous; pH — 8.0.

EARLTON SERIES

LOCALITY: Lot 17, Con. IV, Billings Twp.

PARENT MATERIAL: Calcareous, stonefree silt loam

CLASSIFICATION: Great Soil Group — Grey Wooded
Soil Group — Gleyed Grey Wooded
Family — Earlton

DESCRIPTION: A_0 — Thin layer of partially decomposed leaves, twigs, etc.

A_1 — 0-3 inches silt loam; dark grey (10 YR 4/1); fine granular structure; friable consistency; stonefree; pH — 6.0.

A_2 — 3-8 inches silt loam; light grey (2.5 Y 7/2); mottled; fine platy; friable; stonefree; pH — 5.6.

AB—8-17 inches silty clay loam; light yellowish brown (2.5 Y 6/4); mottled; fine nuciform; firm; aggregates coated with light grey materials; stonefree; pH — 6.5.

B_2 — 17-26 inches silty clay loam; light olive brown (2.5 Y 5/4); mottled; medium nuciform; firm; stonefree; pH — 7.0.

C — Silt loam; pale brown (10 YR 6/3); laminar; friable; stonefree; calcareous; pH — 8.0.

TABLE 19

CHEMICAL AND PHYSICAL ANALYSES OF CULTIVATED SURFACE FROM SOME EARLTON SOILS

Horizon	Location			Mechanical Analyses			Exchange Capacity m.e./100 gm.	Exchangeable Bases			pH	% O.M.
	Township	Conc.	Lot	% Sand 1-.05 mm	% Silt .05-.002 mm	% Clay <.002 mm		Ca m.e./100 gm.	Mg m.e./100 gm.	K m.e./100 gm.		
Cultivated Surface	Carnarvon	X	3	31.2	56.5	12.3	9.82	3.85	0.62	0.13	5.7	2.7
" "	Carnarvon	IX	2	13.9	65.1	21.0	13.23	11.13	2.35	0.09	6.9	2.9
" "	Gordon	VIII	19	28.7	50.5	20.8	12.94	9.67	2.46	0.14	6.5	3.3

CANE SERIES

LOCALITY: Lot 4, Con. XI, Carnarvon Twp.

PARENT MATERIAL: Calcareous, stonefree silt loam

CLASSIFICATION: Great Soil Group — Dark Grey Gleisolic
Soil Group — Orthic Dark Grey Gleisolic
Family — Colwood

DESCRIPTION: A_0 — Thin layer of partially decomposed leaves, twigs, etc.

A_1 — 0-6 inches silt loam; very dark grey (10 YR 3/1); medium granular structure; friable consistency; stonefree; pH — 6.7.

G_1 — 6-20 inches silt loam; pale yellow (2.5 Y 7/4); very mottled; mottles olive yellow (2.5 Y 6/8); laminar; friable; pH — 7.0.

G_2 — 20-29 inches silt loam; light yellowish brown (2.5 Y 6/4); very mottled; massive; friable; stonefree; pH — 7.4.

C — Silt loam; light grey (10 YR 7/2); laminar; friable; stonefree; calcareous; pH — 8.0.

CAMPBELL SERIES

LOCALITY: Lot 7, Con. X, Campbell Twp.

PARENT MATERIAL: Calcareous, stonefree silty clay

CLASSIFICATION: Great Soil Group — Grey Wooded
Soil Group — Orthic Grey Wooded
Family — Haileybury

DESCRIPTION: A_0 — Thin layer of partially decomposed leaves, twigs, etc.

A_1 — 0-1 inches silty clay loam; dark grey (10 YR 4/1); fine nuciform structure; friable consistency; stonefree; pH — 5.8.

A_2 — 1-9 inches silty clay loam; light grey (10 YR 7/2); fine platy; firm; stonefree; pH — 6.2.

AB—9-16 inches clay; pale brown (10 YR 6/3); medium blocky; hard; aggregates coated with light grey materials; stonefree; pH — 6.5.

B_2 — 16-21 inches clay; brown (10 YR 5/3); coarse blocky; very hard when wet, very plastic when dry; stonefree; pH — 6.7.

C — Silty clay; light brownish grey (10 YR 6/2); very hard when dry, very plastic when wet; stonefree; calcareous; pH — 7.8.

GORDON SERIES

OCALITY: Lot 25, Con. VII, Burpee Twp.

ARENT MATERIAL: Calcareous, stonefree silty clay

LASSIFICATION: Great Soil Group — Grey Wooded
Soil Group — Gleyed Grey Wooded
Family — Renfrew

ESCRIPTION: A_0 — Thin layer of partially decomposed leaves, twigs, etc.

A_1 — 0-2 inches silty clay loam; dark grey (10 YR 4/1); fine nuciform structure; friable consistency; stonefree; pH — 6.4.

A_2 — 2-7 inches silty clay loam; very pale brown (10 YR 7/3); mottled; weak fine platy; friable; stonefree; pH — 6.3.

AB—7-11 inches clay; pale brown (10 YR 6/3); mottled; medium blocky; hard; aggregates coated with very pale brown materials; stonefree; pH — 6.5.

B_2 — 11-17 inches clay; brown (10 YR 5/3); mottled; medium blocky; very hard when dry, very plastic when wet; stonefree; pH — 6.9.

C — Silty clay; light brownish grey (10 YR 6/2); very hard when dry, very plastic when wet; stonefree; calcareous; pH — 7.8.

TABLE 20

CHEMICAL AND PHYSICAL ANALYSES OF CULTIVATED SURFACE FROM SOME GORDON SOILS

Horizon	Location			Mechanical Analyses			Ex-change Capacity m.e./100 gm.	Exchangeable Bases			pH	% O.M.
	Township	Conc.	Lot	% Sand 1-.05 mm	% Silt .05-.002 mm	% Clay <.002 mm		Ca m.e./100 gm.	Mg m.e./100 gm.	K m.e./100 gm.		
Cultivated Surface	Campbell	XI	15	15.0	58.5	26.5	14.87	9.59	2.39	0.16	6.1	3.3
" "	Campbell	X	15	19.4	47.4	33.2	16.61	8.09	2.00	0.20	5.7	3.1
" "	Tehkummah	I	15	13.7	54.9	31.4	14.09	9.42	2.43	0.15	6.4	3.2

WOLSEY SERIES

LOCALITY: Lot 25, Con. IV, Mills Twp.

PARENT MATERIAL: Calcareous, stonefree silty clay.

CLASSIFICATION: Great Soil Group — Dark Grey Gleisolic
Soil Group — Orthic Dark Grey Gleisolic
Family — Brookston

DESCRIPTION: A_0 — Thin layer of partially decomposed leaves, twigs, etc.

A_1 — 0-5 inches silty clay loam; dark grey (10 YR 4/1); fine nuciform structure; plastic consistency when wet, friable when dry; stonefree; pH — 6.8.

G_1 — 5-9 inches silty clay loam; dark greyish brown (10 YR 4/2); very mottled; plastic when wet, hard when dry; medium blocky; stonefree; pH — 7.1.

G_2 — 9-15 inches silty clay loam; greyish brown (10 YR 5/2); very mottled; coarse blocky; plastic when wet, hard when dry; stonefree; pH — 7.4.

C — Silty clay light brownish grey (10 YR 6/2); mottled; very plastic when wet, very hard when dry; stonefree; calcareous; pH — 7.8.

TABLE 21

CHEMICAL AND PHYSICAL ANALYSES OF CULTIVATED SURFACE FROM SOME WOLSEY SOILS

Horizon	Location			Mechanical Analyses			Ex-change Capacity m.e./100 gm.	Exchangeable Bases			pH	% O.M.
	Township	Conc.	Lot	% Sand 1-.05 mm	% Silt .05-.002 mm	% Clay <.002 mm		Ca m.e./100 gm.	Mg m.e./100 gm.	K m.e./100 gm.		
Cultivated Surface	Carnarvon	IV	16	20.2	40.2	39.6	18.96	17.04	3.54	0.18	7.4	3.4
" "	Robinson	VI	14	13.9	55.1	31.0	27.23	24.13	3.76	0.19	7.0	5.9
" "	Tehkummah	A	23	21.6	48.4	30.0	25.80	23.76	4.89	0.19	7.6	5.3
" "	Dawson	IX	26	17.3	51.2	31.5	23.36	20.05	3.72	0.18	7.1	4.9

PIKE SERIES

LOCALITY: Lot 5, Con. XI, Bidwell Twp.
PARENT MATERIALS Calcareous, stonefree clay
CLASSIFICATION: Great Soil Group — Grey Wooded
Soil Group — Orthic Grey Wooded
Family — Haileybury

DESCRIPTION: A_0 — Thin layer of partially decomposed leaves, twigs, etc.
A_1 — 0-2 inches clay; light brownish grey (10 YR 6/2); fine nuciform structure; very plastic consistency when wet, friable when dry; stonefree; pH — 6.4.
A_2 — 2-5 inches clay; light grey (10 YR 7/2); medium nuciform; very plastic when wet, very hard when dry; stonefree; pH — 6.4.
AB—5-9 inches clay; pale brown (10 YR 6/3); coarse nuciform structure; very plastic when wet, very hard when dry; stonefree; pH — 6.7.
B_2 — 9-15 inches clay; yellowish brown (10 YR 5/4); mottled; massive; very plastic when wet, very hard when dry; stonefree; pH — 7.2.
C — Clay; grey (10 YR 6/1); mottled; massive; very plastic when wet, very hard when dry; stonefree; pH — 7.6.

BASS SERIES

LOCALITY: Lot 7, Con. I, Howland Twp.
PARENT MATERIAL: Calcareous, stonefree clay.
CLASSIFICATION: Great Soil Group — Grey Wooded
Soil Group — Gleyed Grey Wooded
Family - Renfrew

DESCRIPTION: A_0 — Thin layer of partially decomposed leaves, twigs, etc.
A_1 — 0-3 inches clay; dark grey (10 YR 4/1); fine nuciform structure; very plastic consistency when wet, friable consistency when dry; stonefree; pH — 6.1.
A_2 — 3-7 inches clay; pale brown (10 YR 6/3); mottled; fine nuciform; very plastic when wet, very hard when dry; stonefree; pH — 6.1.
B_2 — 7-14 inches clay; light yellowish brown (10 YR 6/4); mottled; coarse nuciform; very plastic when wet, very hard when dry; stonefree; pH — 6.8.
C — Clay; grey (10 YR 6/1); mottled; very plastic when wet, very hard when dry; stonefree; calcareous; pH — 7.6.

PERCH SERIES

LOCALITY: Lot 9, Con. I, Howland Twp
PARENT MATERIAL: Calcareous, stonefree clay
CLASSIFICATION: Great Soil Group — Dark Grey Gleisolic
Soil Group — Orthic Dark Grey Gleisolic
Family — Welland

DESCRIPTION: A_0 — Thin layer of partially decomposed leaves, twigs, etc.
A_1 — 0-6 inches clay; very dark grey (10 YR 3/1); fine nuciform structure; very plastic consistency when wet, friable when dry; stonefree; pH — 6.6.
G — 6-15 inches clay; light brownish grey (10 YR 6/2); very mottled; massive; very plastic when wet, very hard when dry; stonefree; pH — 7.0.
C — Clay; grey (10 YR 6/1); very mottled; massive; very plastic when wet, very hard when dry; stonefree; calcareous; pH — 7.6.

FARMINGTON SERIES

LOCALITY: Lot 14, Con. XI, Allan Twp.
PARENT MATERIAL: Calcareous loam till over limestone bedrock at depths of less than 1 foot.
CLASSIFICATION: Great Soil Group — Brown Forest
Soil Group — Orthic Brown Forest
Family — Farmington
DESCRIPTION: A_0 — Thin layer of partially decomposed leaves, twigs, etc.
A_1 — 0-5 inches loam; very dark greyish brown (10 YR 3/2); fine granular structure; friable consistency; moderately stony; pH — 7.2.
B_2 — 5-9 inches loam; dark brown (10 YR 4/3); weak medium nuciform; friable; moderately stony; pH — 7.6.
C — 9-10 inches gravelly loam till; pale brown (10 YR 6/3); loose; stony; calcareous; pH — 8.0.
D — Limestone bedrock.

KAGAWONG SERIES

LOCALITY: Lot 16, Con. XI, Billings Twp.
PARENT MATERIAL: Calcareous, stonefree silt loam over limestone bedrock at depths of less than 1 foot.
CLASSIFICATION: Great Soil Group — Brown Forest
Soil Group — Orthic Brown Forest
Family — Ameliasburg
DESCRIPTION: A_0 — Thin layer of partially decomposed leaves, twigs, etc.
A_1 — 0-4 inches silt loam; dark grey (10 YR 4/1); medium granular structure; friable consistency; moderately stony; pH — 6.8.
B_2 — 4-8 inches silt loam; yellowish brown (10 YR 5/6); weak medium nuciform; friable; stonefree; pH — 7.2.
C — 8-10 inches silt loam; pale brown (10 YR 6/3); laminar; firm; calcareous; pH — 7.8.
D — Limestone bedrock.

LITTLE CURRENT SERIES

LOCALITY: Lot 17, Con. XI, Howland Twp.

PARENT MATERIAL: Calcareous clay over shale bedrock at depths of less than 1 foot.

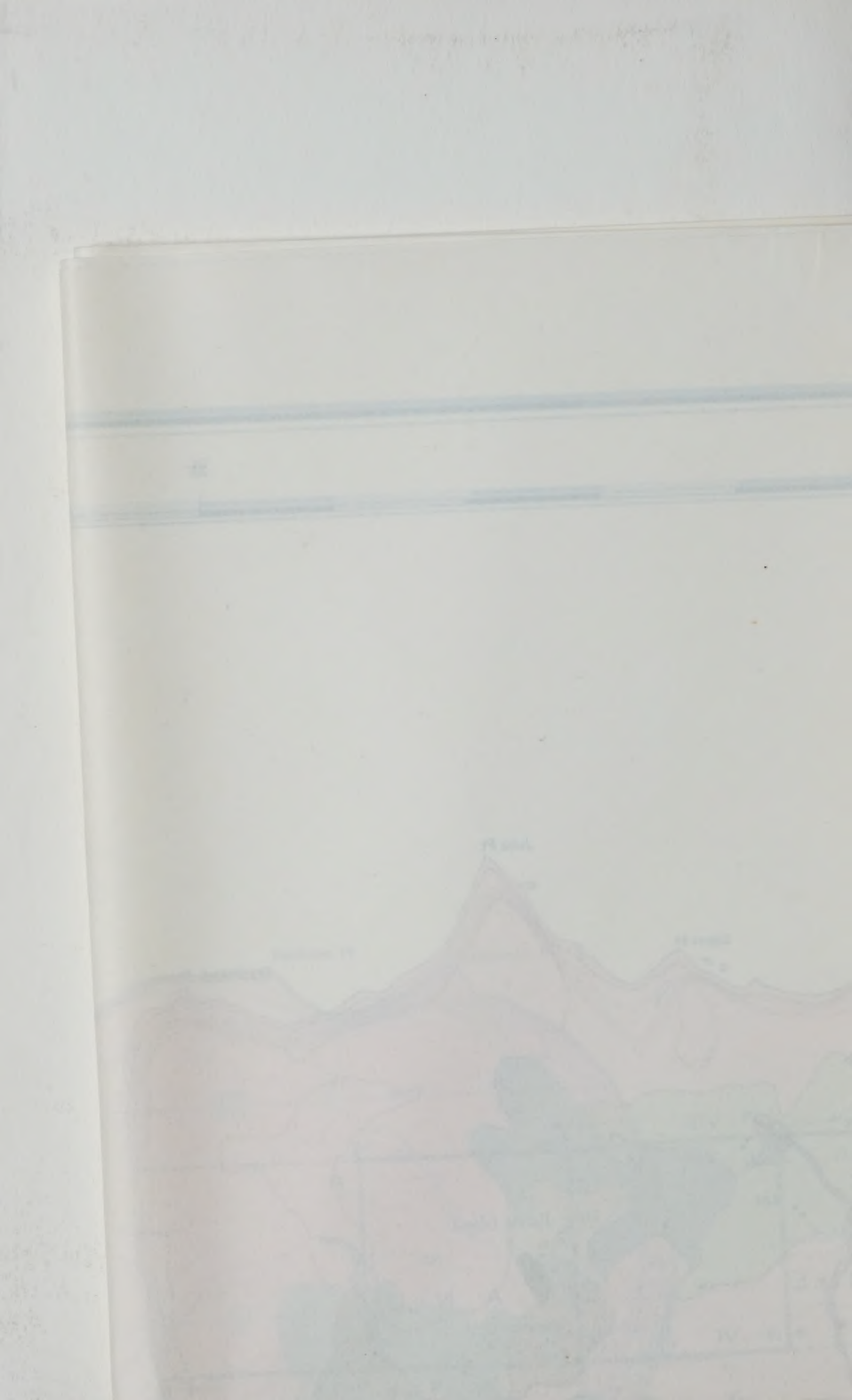
CLASSIFICATION: Great Soil Group — Brown Forest
Soil Group — Orthic Brown Forest
Family — Ameliasburg

DESCRIPTION: A_0 — Thin layer of partially decomposed leaves, twigs, etc.

A_1 — 0-4 inches clay; very dark grey (10 YR 3/1); fine nuciform structure; very plastic when wet, friable when dry; stonefree; pH — 6.5.

B_2 — 4-8 inches clay; very dark greyish brown (10 YR 3/2); very plastic when wet, very hard when dry; stonefree; pH — 7.2.

D — Shale bedrock.



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